GOVERNMENT BOTANICAL GARDENS
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PLATE I. FIRST HOME OF THE BUREAU OF AGRICULTURE.

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THE PHILIPPINE
Agricultural Review

VOL. II JANUARY, 1909 No. 1

EDITORIAL.

With this issue of the PHILIPPINE AGRICULTURAL REVIEW we enter upon the second year of our existence. Following the precedent established in the first number of Volume I we are devoting the first number of Volume II to the report of the Director of Agriculture for the last fiscal year. On account of the length of this report and the great variety of subjects covered, nothing else will be included in this issue. There is no necessity for additional comment as the report is self-explanatory. It may be of interest, however, to call attention to a few facts in connection with the history of the Bureau of Agriculture.

It was organized April 30, 1902, in accordance with the provisions of Act No. 261 of the Philippine Commission. The first Director was Dr. F. Lamson-Scribner, for many years Agrostologist in the Department of Agriculture, Washington. He was appointed in Washington at the request of the Philippine Commission. He arrived in Manila on April 22, 1902, and at once began the organization of this Bureau, the office of which was first located in a roomy old Spanish residence at No. 155 Calle Nozaleda. Mr. W. C. Welborn was appointed Assistant Chief, and entered upon his duties on July 13, 1903. Dr. Scribner left for the United States on leave December 20, 1903, and did not again return to duty here. Mr. Welborn was appointed Chief of the Bureau July 1, 1904. The present Director was appointed Assistant Chief in August and entered upon his duties October 10 of the same year. Under the provisions of Act No. 1407 the titles of Chief and Assistant Chief were changed to Director and Assistant Director, and reappointments made effective November 1, 1905. The resignation of Mr. Welborn and the appointment of the present Director and Assistant Director are chronicled under the heading of "Personnel" in this report.

The nature and extent of the work which the Bureau of Agriculture performs has changed very greatly during its existence. In looking back over the early records it appears that when first organized the work of the Bureau was largely devoted to the operation of a number of demonstration farms, the distribution of seeds, the collecting of information regarding the agriculture of the Islands, and the publication of literature on agricultural subjects.

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The tendency at the beginning was to establish a great number of farms which should be devoted largely to demonstrating to the people better methods of conducting farming operations. There seems to have been no limit to the size of the farms established, and it is a matter of record that at one time the Murcia rice farm contained 500 acres of growing rice. In fact the farm grew to be so extensive that all experimental and demonstration work was lost sight of, and it was operated almost exclusively as a commercial enterprise. A reaction set in in the latter part of the year 1905 and several of the demonstration farms were abandoned and other farms were established which are operated as experiment stations.

The transfer to the Bureau of Agriculture of the veterinary division of the Bureau of Health and the Lamao Forest Reserve from the Bureau of Forestry, effective November 1, 1905, gave a strong impetus to the growth of this Bureau. By virtue of these transfers it received more than twice the number of classified employees then in its service. On January 1, 1907, the entire serum herd was transferred to it from the Bureau of Science. During all this time there was a constant growth in the Bureau itself. Special demands arose. The publication of the PHILIPPINE AGRICULTURAL REVIEW, the agricultural exploration and extension work, the crop-reporting service, the operation of steam plows for the reclaiming of friar lands, and the construction and maintenance of live-stock depots and quarantine stations at ports of entry in these Islands—all these have resulted in the establishing of additional lines of work and the creation of new offices.

All of this growth has been very rapid, but of such logical nature as to attract little attention. One who knew the Bureau five years ago would scarcely recognize it to-day. It has grown from a small administrative office to a large, active Bureau, the work of which covers the entire Islands. It has not yet reached its greatest usefulness, nor the warmest place in the estimation of the people. It does not rank as a first-class Bureau, but it will certainly attain that rank in the very near future, purely by the merits of its work and with the approval of the great mass of people whom it serves.

REPORT OF THE BUREAU OF AGRICULTURE FOR THE FISCAL YEAR ENDING JUNE 30, 1908.

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BUREAU OF AGRICULTURE,
Manila, August 8, 1908.

SIR: I have the honor to submit herewith my report as Director of Agriculture for the fiscal year ending June 30, 1908:

ORGANIZATION.

The organization of the Bureau of Agriculture includes the following three divisions: Administrative, plant industry, and animal industry. There has been no change in the division organization of the Bureau during the year.

ADMINISTRATIVE DIVISION.

The increasing amount of executive and clerical work, the publication of a monthly journal, and the growth of the crop-reporting service have necessitated the reorganization of this division. In February, 1908, the position of chief clerk and that of fiber expert were abolished and an Assistant to the Director was appointed as chief of the administrative division. As a result of this reorganization, the Director has been relieved of a large amount of minor executive work and the work of subordinate employees has been more clearly defined.

The administrative division now includes the following subdivisions: Clerical, agricultural extension work, crop-reporting and statistics, agricultural explorations, steam plowing and machinery investigations, publications, and library and museum.

PERSONNEL.

The Bureau force at present consists of the Director, Assistant Director, Assistant to the Director, superintendent of agricultural extension work, statistician, agricultural explorer, cashier, property clerk, machinery expert, fifteen veterinarians, five agricultural inspectors, five assistant agricultural inspectors, two stenographers, twelve clerks, three farm superintendents, three farm foremen, dairyman, stable foreman, carpenter, matadero inspector, twelve temporary employees, live-stock inspectors, messengers, and laborers at stations and farms.

The following is a complete record of changes in personnel during the year: G. E. Nesom, Assistant Director, appointed Director August 1, 1907; Charles M. Conner, appointed Assistant Director January 28, 1908; H. T. Edwards, fiber expert, appointed Assistant to the Director February 20, 1908; Pablo Tecson, appointed superintendent of agricultural extension work August 1, 1907; F. L. McVeigh, chief clerk, appointed cashier March 16, 1908; Thomas R. Flack, clerk, appointed statistician October 1, 1907; Harold Cuzner, superintendent of experiment station, appointed agricultural explorer January 1, 1908; Frank C. Gearhart appointed veterinarian August 14, 1907; S. Youngberg, appointed veterinarian August 27, 1907; James R. Love, appointed veterinarian August 27, 1907; C. G. Thomson, appointed veterinarian September 5, 1907; R. F. Knight, appointed veterinarian September 5, 1907; C. H. Leavitt, appointed veterinarian December 13, 1907; J. E. Nance, appointed veterinarian March 4, 1908; David McKibbin, jr., appointed veterinarian March 30, 1908; T. B. Boone, appointed stenographer February 20, 1908; H. N. Knight, agricultural inspector, appointed farm superintendent October 1, 1907; J. B. Thompson, agricultural inspector, appointed farm superintendent October 1, 1907; B. J. Epes, appointed clerk March 1, 1908; Oscar Franden, assistant agricultural

inspector, appointed clerk January 1, 1908; R. L. Clute, appointed agricultural inspector August 17, 1907; B. C. Ray, inoculator, appointed assistant agricultural inspector January 1, 1908; George C. Kramer, appointed assistant agricultural inspector January 28, 1908; H. A. Ireland, appointed assistant agricultural inspector February 19, 1908; A. F. Byars, appointed assistant agricultural inspector February 9, 1908; G. A. Webster, appointed clerk July 11, 1907; M. Calayag, appointed clerk September 1, 1907; E. Servando, appointed clerk July 16, 1907; J. Aragon, live-stock inspector, appointed clerk October 3, 1907; R. Dacanay, appointed clerk October 15, 1907; A. Peña, appointed clerk March 1, 1908.

Loss by resignation, W. C. Welborn, Director, resignation cabled from Washington July 18 and accepted, effective June 3, 1907; W. S. Lyon, horticulturist, September 16, 1907; H. B. Ross, farm foreman, October 5 ,1907; A. S. Ashe, disbursing officer, La Trinidad, February 20, 1908; Henry Dusdieker, assistant agricultural inspector, March 9, 1908; G. A. Webster, clerk, March 17, 1908; one employee was removed.

The year shows a gain of 22 and a loss of 6, or a net increase of 16 classified employees.

The veterinary force has been considerably increased during the year, but after providing for veterinary inspectors at Manila, Iloilo, and Cebu, only one veterinarian was available for each four provinces and important islands. This made it impossible to cover the territory as thoroughly as was desired, has necessitated responding to calls only where the outbreaks of disease appeared to be serious, and has resulted in some small outbreaks assuming a serious aspect before attention could be given to them.

Not only the veterinarians, but also our agricultural inspectors and assistant agricultural inspectors have been used in connection with the veterinary control work. Owing to the widespread prevalence of rinderpest, foot-and-mouth disease, and surra, our veterinary force is still too small to satisfactorily handle the work. The appointment of a chief veterinarian and a small increase in the veterinary force have been authorized and all vacancies will be filled at as early a date as practicable. It is probable that less difficulty will be experienced in securing veterinarians than heretofore, as a number of eligibles are now awaiting appointment.

Three new agricultural inspectors, all of whom are agricultural college graduates, arrived in Manila in January and February, 1908. The excellent services which these inspectors have rendered emphasizes the desirability of obtaining trained men for this work. During the year four agricultural inspectors have been transferred to positions as farm superintendents and four additional inspectors employed to take their

places, all of whom have been given special training in the control of animal diseases.

The clerical force has been materially enlarged during the year. This increase has been made necessary by the publication of the PHILIPPINE AGRICULTURAL REVIEW, the growth of our crop reporting and statistical work, and the large increase in record work due to enlarged field force. A number of transfers and changes have been made in the clerical force, which have resulted in considerable improvement in results accomplished. A large part of the increase in the clerical force has been in the number of native clerks employed. In general, the work of these clerks is highly satisfactory.

PUBLICATIONS.

PHILIPPINE AGRICULTURAL REVIEW.

In July, 1907, the Director of Agriculture, in recommending the publication of a monthly bulletin by this Bureau, stated as follows:

> It is essential that the farmers throughout the provinces be brought more closely in touch with the work of the Bureau of Agriculture. This fact is of particular importance in connection with our seed and plant distribution and the control of infective animal diseases. A considerable amount of the work now accomplished by means of circulars, circular letters, and correspondence could be more satisfactorily and thoroughly done through the medium of a monthly publication.
>
> We are now receiving monthly crop-service reports from more than half the municipalities of the Islands. A brief summary of these reports would be of general interest, if published regularly every month.
>
> The further development of the maguey industry, the planting of kapok trees, and other similar lines of work should be systematically and constantly kept before the people. Interest in these questions is easily aroused, but soon dies out unless constantly renewed. This kind of work can not be done thoroughly either by correspondence or by our present system of bulletins.

The first number of the PHILIPPINE AGRICULTURAL REVIEW was published in January, 1908. This journal is destined primarily to take the place of the press bulletins heretofore issued by this Bureau. It is not intended to be a journal of technical nature, but rather a serial publication on general agriculture to be used as an educational means of reaching the people of the Philippine Islands with the work of the Bureau of Agriculture. The REVIEW is issued in English and Spanish and is circulated free of charge in the Philippine Islands.

The January number of the REVIEW was devoted entirely to the annual report of the Bureau for the preceding fiscal year. Subsequent numbers have contained articles on various subjects of general agricultural interest, reports on agricultural conditions in the provinces and in other tropical countries, crop reports, statistics, etc.

On June 30, 1908, the mailing list of the REVIEW was as follows:

English, 2,555; Spanish, 5,431. This publication is sent to all provincial governors and treasurers, division superintendents of schools, municipal presidents, crop reporters, supervising teachers, agricultural colleges and experiment stations in the United States, and to a selected list of agricultural periodicals, libraries, American consuls, botanical gardens, and private individuals.

Large numbers of requests for the REVIEW have been received, and although great care has been taken in making up the mailing list, the entire Spanish editions of Nos. 1, 2, and 3 have been exhausted. The question of charging a nominal subscription price for the REVIEW is one that will have to be taken up in the near future.

BULLETINS AND CIRCULARS.

The publication and wide distribution of the PHILIPPINE AGRICULTURAL REVIEW have resulted in a largely increased demand for publications on agricultural subjects. We have issued during the year one farmers' bulletin, one press bulletin, and one printed circular. A large amount of the material formerly published in bulletins and circulars can now be published in the REVIEW. It will probably be desirable, however, to continue our series of farmers' bulletins and popular bulletins.

During the year the following publications have been issued:

Title.	Author.	Issued.	Language.
Farmers' Bulletin No. 15, Tobacco Growing in the Philippines.	G. E. Nesom	Dec. 11, 1907	English.
		Jan. 13, 1908	Spanish.
		Jan. 30, 1908	Ibanag.
		Jan. 31, 1908	Ilocano.
Press Bulletin No. 11, Seed Distribution, Need of Diversified Farming, etc.	do	Oct. 28, 1907	English.
		Dec. 11, 1907	Spanish.
Circular, Kapok	H. T. Edwards	Nov. 5, 1907	English.
		Nov. 6, 1907	Spanish.
		Jan. 7, 1908	Cebuano.
		Jan. 9, 1908	Visayan.
		Jan. 29, 1908	Ilocano.
		do	Tagalog.

PHILIPPINE AGRICULTURAL REVIEW, VOLUME I.

No. 1 (January).—*Contents:* Annual report of the Bureau of Agriculture for the fiscal year ending June 30, 1907.

No. 2 (February).—*Contents:* Forage investigations in the Philippine Islands, agricultural progress in Porto Rico, agricultural conditions in the Province of Nueva Ecija, hog cholera, school gardening in the Province of Union, commercial orange production in the Philippine Islands, the world's rice crop, range of prices of Philippine Agricultural products.

No. 3 (March).—*Contents:* Rinderpest, surra, foot-and-mouth disease, anthrax, hog cholera, glanders, hemorrhagic septicemia, ulcerative lymphangitis, methods of disinfecting.

No. 4 (April).—*Contents:* Manioc or cassava, poultry raising, La Granja Modelo, February crop reports, range of prices of Philippine agricultural products.

No. 5 (May).—*Contents:* The animal-disease problem, Bureau of Agriculture General Order No. 10, report on the animal industry of Indo-China, locusts, bud-rot of the coconut, crop-reporting service, agricultural notes from April crop reports, range of prices of Philippine agricultural products.

No. 6 (June).—*Contents:* Agriculture in the Hawaiian Islands (Part I), water and the soil, some information on silkworm culture in the Philippine Islands, agricultural opportunities in the Province of Palawan, agricultural notes, crops planted and harvested and condition of same, range of prices of Philippine agricultural products.

AGRICULTURAL EXTENSION WORK.

OUTLINE OF WORK.

On August 1, 1907, Pablo Tecson, formerly governor of the Province of Bulacan, was appointed superintendent of agricultural extension work.

The principal object in view in organizing this work was to bring the people of the Islands more closely in touch with the work of the Bureau of Agriculture. An attempt has been made to make the work practical by dealing with everyday subjects, such as the treatment of rinderpest and other animal diseases, methods of checking the spread of these diseases, the advantages of planting maguey and other crops, etc.

The superintendent of agricultural extension work has also brought to the attention of the people certain lines of work of this Bureau, such as the distributing of seeds and plants, the results obtained at our experiment stations, and the use of anti-rinderpest serum.

During the year the superintendent has made investigations in the Provinces of Batangas, Bulacan, Negros Occidental, Nueva Ecija, and Tarlac. In each of these provinces meetings were held for the purpose of explaining to the people the work of this Bureau along the lines above mentioned.

In each municipality visited, the superintendent, after having obtained information regarding soil conditions, irrigation facilities, agricultural products, condition of live stock, etc., has offered such suggestions for the improvement of agricultural conditions as the situation called for.

BATANGAS.

In September, 1907, an investigation was made in the Province of Batangas, in the course of which the towns of Santo Tomas, Tanauan, Lipa, Bauan, Taal, Lemery, Calaca, Balayan, Nasugbu, and Batangas were visited. Rinderpest was found in all of these towns, conditions being most severe at Bauan. It was noted in several of these places that the disease was first reported among animals arriving from the Visayan Islands.

The large number of people interviewed in these towns expressed appreciation of the good results obtained through inoculation with anti-rinderpest serum and appeared to be convinced of the efficacy of this

serum. Both municipal officials and owners of live stock requested that larger quantities of serum be sent to the province so that more extensive inoculations might be made.

NUEVA ECIJA.

In the month of December, 1907, an investigation was made in the Province of Nueva Ecija and the towns of Cabanatuan, Bongabon, Pantabangan, Carrancalan, Licab, Talavera, Gapan, San Antonio, Aliaga, San Jose, San Juan de Guimba, and Cuyapo were visited. In practically all of the towns visited in this province it was found that the rice crop had suffered severely from drought, the shortage being in some places from 70 to 90 per cent.

No diseases among live stock were found.

In many of the towns visited, crops such as coconuts, cacao, coffee, kapok, maguey, and cotton might be advantageously grown. This fact was brought to the attention of the farmers and property owners throughout the province and all were advised to encourage the cultivation of these crops.

BULACAN.

During the month of January, 1908, an investigation was made of agricultural conditions in this province, which, like Nueva Ecija, suffered great loss in the rice crop by reason of drought.

This investigation was made especially for the purpose of determining the irrigation facilities in the province. It was recommended that a canal be opened in the Rio Grande of Pampanga for the purpose of irrigating rice lands in the municipalities of Hagonoy and Calumpit, and it was estimated that if such a canal were opened the production of rice in these towns could be increased by at least 20 per cent.

OCCIDENTAL NEGROS.

This investigation was made during the month of February, 1908. Among the towns visited were Pontevedra, Jinigaran, Binalbagan, Jimamaylan, Cabancalan, Ilog, Isabela, and La Carlota. This investigation was made for the special purpose of learning the existing conditions with regard to the prevalence of rinderpest and of furnishing the people with information regarding the use of anti-rinderpest serum.

In all of the municipalities visited, meetings were held and the people were told of the successful results obtained in other provinces in fighting rinderpest by means of inoculation and quarantine. The impression made on the people was most satisfactory, and it is believed that a large number of the "hacenderos" of this province are now convinced of the value of this serum. Many of them requested the superintendent of agricultural extension work to make arrangements for the inoculation of their animals and offered to pay the cost of same.

TARLAC.

This investigation was made in the month of May, 1908. Among the towns visited were Victoria, Pura, Paniqui, Camiling, Moncada, Capas, Concepcion, and Bamban.

The principal products in this province are rice, sugar cane, and corn; coconuts, ylang-ylang, and maguey are cultivated to a limited extent. The amount of rice harvested last December and January was small, the shortage being estimated at about 50 per cent, due both to drought and excessive rain. Corn and sugar cane were found to be doing well with prospects of a considerable crop.

Little disease among live stock was reported, there being only a few cases of foot-and-mouth disease and rinderpest.

CROP REPORTING AND STATISTICS.

STATUS OF WORK.

The crop reporting and statistical work of the Bureau was organized during the latter part of 1906. The proposed work, as stated in our last annual report, was—

> To obtain regular and reliable information relative to crops and live stock in all parts of the Islands, to summarize and tabulate this information so that it may be in the highest degree useful and available, and to publish such part of the information received as may seem desirable.

At the close of the last fiscal year on June 30, 1907, a corps of 370 municipal reporters had been organized and 1,628 monthly crop reports had been received. No attempt had been made to tabulate any statistics or to publish any crop reporting material.

During the present year the number of crop reporters has been substantially increased. The quality and regularity of the monthly reports have been improved. The large amount of data received has been tabulated and made available for ready reference, and the regular publication of crop reporting and statistical material in the PHILIPPINE AGRICULTURAL REVIEW has been effected.

During the first part of the present fiscal year Mr. J. B. Thompson was acting statistician. On October 1, 1907, Mr. T. R. Flack was appointed statistician and performed the duties pertaining to this office during the remainder of the year.

COMPILATION OF DATA.

Data of the kind received in crop reports, in order to be of any practical value, must be so tabulated and arranged as to be available on short notice. The necessary forms for tabulation were received early in the year and within a period of about two months the work of tabulating the statistics received was brought up to date.

PUBLICATION OF CROP REPORTS.

The publication of data received is an essential part of the crop reporting service, and one of the objects in view in publishing the PHILIPPINE AGRICULTURAL REVIEW was to furnish a means of disseminating among the people the information obtained through the medium of the crop reporting service. There is now published in each number of the REVIEW a tabulated statement showing the range of prices of the more important Philippine crops. In the April number of the REVIEW, in order to give the people a clear idea of the crop reporting work, we published a brief summary showing weather conditions, crops planted and harvested, etc., during the month of February, in all of the municipalities from which crop reports had been received. Notes of a similar nature, but in a more condensed form, were published in the May number of the REVIEW. The June number contained brief notes on agricultural conditions and also a tabulated statement showing the crops planted and harvested and the condition of growing crops during the month of May.

QUALITY OF THE REPORTS.

There has been considerable improvement during the year in the quality of the crop reports received. It is believed that the publication of these reports will result in still further improvement, for the following reasons: When a subscriber of the REVIEW reads the crop reports published therein and notes that the statements relative to crops in his municipality are not correct, it is probable that in many cases he will consult with the Bureau's correspondent in that municipality and offer suggestions as to how reports may be improved. Furthermore, crop reporters themselves, when they learn that their reports are being published and read by persons in their own municipality, will endeavor to submit reports as free from errors as possible.

SPECIAL REPORTS.

Accompanying the regular monthly report blanks, there have been sent out at frequent intervals blank forms on special subjects, such as the mulberry, agricultural machinery, the mango, etc., to be filled out and returned by the reporters. These special reports have been compiled and furnish much valuable information.

RECEIPT OF REPORTS.

One drawback to this service is the infrequency of mail communications between Manila and many places in the Islands, some places receiving mail but once a month and others only twice a month. It often happens therefore, that reports are received several weeks or a

month late. This difficulty has been overcome to some extent by sending out report blanks to the more distant provinces a considerable period in advance of those provinces which are located near Manila.

SUCCESS OF SERVICE.

The practicability of organizing and carrying on a crop-reporting service in the Philippine Islands has been fully demonstrated. The majority of the municipal reporters have never done any work of this character before, and various other obstacles of more or less serious nature have had to be overcome. Considering these facts, the results obtained have been very satisfactory.

The municipal elections which occurred in the early part of the year seriously interfered with the crop reporting work. The majority of our crop reporters are municipal presidents, many of whom were not reëlected. In a large number of cases the ex-presidents failed to inform their successors in regard to the crop reporting work, and although the Bureau continued to send blank forms every month they were not filled in and returned as formerly. It was some time before the true state of affairs became apparent, and then steps were taken to immediately remedy the difficulty. Letters were sent to the municipalities from which reports were not being received, explaining the nature of the crop reporting service and asking for the hearty coöperation of the officials. Letters were also sent to the provincial governors and division superintendents of schools, requesting that they correspond with those municipalities from which reports were not being received, with a view to securing persons to act as crop reporters. It is gratifying to note that correspondents have been obtained in many of these municipalities, and a larger number of reports are now being received than during any previous time since the organization of the crop-reporting service.

AGRICULTURAL EXPLORATIONS.

It has been found necessary to detail Mr. Harold Cuzner, agricultural explorer, to the work of seed and plant introduction and distribution during the greater part of the year. For this reason, exploration work has been limited to short trips through the provinces near Manila.

INVESTIGATIONS IN THE PROVINCE OF BATANGAS.

On December 12, 1907, an inspection trip was made through the Provinces of La Laguna and Batangas. On this trip special attention was paid to leguminous plants that might be useful either for food or for the production of forage. Seeds of *Atylosia scarabacoides, Dolichas falcatus, Uraria lagopdivide,* and *Phaseolus lunatus* were collected, beside several varieties of patani. Of these the *Alysicarpus vaginalis* (mani manihan) is probably the most promising because it is readily

eaten by animals and is often found making a considerable growth in cogon. The seed, however, seems to be difficult to germinate, and only a few plants were obtained from the seed collected.

The orange districts in the neighborhood of Tanauan were visited and many of the trees were found to be suffering from the attack of an insect which was working under the bark. In this district oranges are propagated from seed, with little or no attempt at selection. Cultivation, pruning, and manuring of the trees are entirely neglected. A very bad result of the lack of pruning is that the dead wood becomes infected with white ants and other borers that work their way down to the healthy wood. It was stated by several owners of orange groves that when the trees are in full bearing they yield from 2,000 to 3,000 fruits, valued at ₱4 to ₱5 per thousand. Seedling orange trees are sold in the neighborhood at ₱10 per thousand and many small plantations are being put out.

At a barrio near San Jose, a plantation of Liberian coffee was seen, and although the trees had received little or no attention and were planted very close, they seemed healthy and were bearing a good crop of berries. This variety of coffee, however, does not seem to find much favor on acount of the difficulty in removing the hull. These coffee trees were said to be about fifteen years old and to have been in bearing for the last ten years.

INVESTIGATION OF SUGAR-CANE DISEASE.

During the month of April, 1907, the agricultural explorer, in company with Dr. Robinson, of the Bureau of Science, made a trip to Santa Rosa, La Laguna, to investigate a sugar-cane disease reported from that neighborhood. The field in question was a crop of rattoons and almost every plant was found to be badly infected with "smut" (*Ustilago saccharii*). Owing to the nature of this disease there is no remedy that can be applied to the infected plants. It was recommended that all the infected plants be cut and burned in order to prevent a spread of the infection, also that the land be planted with another crop in order to get rid of spores that were in the soil. The owner agreed to do this and a sufficient quantity of Carolina golden rice with which to sow the field was furnished him.

An investigation of the sugar-cane districts between Santa Rosa and Los Baños was then made to determine the extent of the disease, but no other infected fields were found.

In order to find out whether this disease existed in other localities, a circular letter was sent out to a large number of correspondents of the Bureau, giving a description of the diseased plants, and inquiring as to the existence of the disease in each locality. The reports received, with two exceptions, one from the town of Sampaloc, Tayabas, and the other from Manapla, Occidental Negros, were negative. The disease reported

from Tayabas, on further investigation, proved to be of entirely different nature and not at all dangerous. That reported from Occidental Negros was said to be very limited in extent, affecting only one plant in one thousand. If it exists at all, however, in this important sugar producing province, it should be carefully watched as in time it is liable to become epidemic.

STEAM PLOWING AND MACHINERY INVESTIGATIONS.

PLOWS.

The extra heavy V-shaped plows mentioned in the last annual report have been successful in turning all kinds of land, no matter how hard or foul with grass and weeds. Owing to the fact that these plows throw the dirt in both directions, thus leaving a ridge and a furrow at each passage, necessitating considerable work with disc harrows to level the land, this type of plow was abandoned temporarily and another plow constructed on the general plan of the ordinary disc plow purchased in the market. This new plow, however, is made of extra-heavy material and so reinforced as to withstand the strain put upon it in cutting cogon sod, the roots of young trees, etc.

This plow was a decided success, doing good work on moist land as well as on cogon sod or old land. It will replow the land any number of times, a thing which the V-shaped plow mentioned above will not do, but it will not plow hard, dry land as well as the V-shaped plow. It leaves the land level and in good condition, and if a 5-foot disc harrow is hitched on behind the plow, work equal to two plowings can be done at one passage of the engine.

The ordinary disc plow manufactured in the United States for use on sod land, is not adapted to work in these Islands, owing to its lightness of construction. It is therefore recommended that the attention of plow manufacturers be called to the construction and work of this plow and some reliable firm induced to take up the manufacture of the same. If this is done, when plows are ordered hereafter for work in these Islands we shall have some assurance of their success, with the many objections with regard to breakage, etc., removed.

ENGINES.

This Bureau now has on hand one 35-horsepower engine, one 18-horsepower engine, one 22-horsepower engine, and one 22-horsepower Hart-Parr petroleum-burning engine.

As mentioned in our last report, the friar lands, as they now stand, are not well adapted to the use of steam plowing engines, because of the fact that the fields are small, separated as a rule by ditches or embankments, and grown up with cogon, talahib, and trees of various kinds. The rice dikes and old cane ridges also interfere materially with

the operation of the steam engine, as in crossing these it is necessary to reduce speed. The ground being uneven it is frequently necessary to plow in small patches, owing to the fact that a part of the ground may be too wet while the remainder of the field is in proper condition for plowing. These small fields necessitate frequent turning of the engine which also consumes time.

OPERATIONS.

The 35-horsepower engine and 12-disk plow and the 18-horsepower engine and 6-disk plow were taken to the Santa Rosa Estate on October 22, 1907, and used there until February 8, 1908, at which time the plowing operations ceased on account of the opening of the sugar grinding season.

The following is a detailed statement of the work performed by the 35-horsepower engine and 12-disk plow:

Actual time worked	days	28
Amount of land plowed	hectares	72.2389
Value of 28.3 tons of coal at ₱20 per ton		₱566.66
Wages of one engineer and two firemen		227.64
Repairs and oil (actual days worked)		112.00
Total cost		906.30
Average area plowed per day	hectares	2.58
Average amount of coal consumed per day	tons	1.01
Cost of fuel per hectare		₱7.84
Cost of wages, oil, and repairs per hectare		4.70
Total cost per hectare		12.54

To this must be added the wages of three laborers furnished by the land owner.

The fact that only twenty-eight days of actual work was done with this engine and plow was largely due to weather conditions.

The following is a record of the 18-horsepower engine and 6-disk plow during the same period:

Actual time worked	days	37.50
Amount of land plowed	hectares	67.50
Value of 19 tons of coal, at ₱20 per ton		₱380.00
Wages of one engineer and two firemen		277.50
Repairs and oil (estimated)		90.00
Total cost		747.50
Average area plowed per day	hectares	1.72
Average amount of coal consumed per day	ton	.50
Cost of fuel per hectare		₱5.80
Cost of wages, oil and repairs per hectare		5.44
Total cost per hectare		11.24

To this must be added the wages of one laborer furnished by the land owner.

To give an idea of what the 18-horsepower engine and 6-disk plow can do on a straight run of five days, the following tabulated statement is submitted:

Amount of land plowed	hectares	19
Wages of engineer and two firemen		₱39.50
Wages of six laborers, pumping water and cutting wood, at ₱.60 per day for five days		18.00
Oil, at ₱1 per day		5.00
Total cost		62.50
Average amount of land plowed per day	hectares	3.80
Average cost per hectare		₱3.25

It will be noticed that the average area plowed per day by the 35-horsepower engine and 12-disk plow was much greater than the 18-horsepower and 6-disk plow, but that the cost of plowing is less in the case of the 18-horsepower engine and 6-disk plow, the greater cost of the 35-horsepower engine and 12-disk plow being due largely to the fact that more coal was consumed in operating. If wood could have been substituted for coal and furnished by the land owner, the cost of plowing would have been about the same in both cases. It is believed from the figures given in the last table that the smaller engine and plow will do the work at much less cost, provided many obstructions are removed, as will be mentioned later on in this report.

The cost of plowing shown in the last table could have been materially reduced if water could have been secured near at hand. It was necessary in this case to employ three laborers to pump water from a deep well.

Much of the variation in the cost of plowing, as given from time to time, is due to the different conditions with which the plows have to contend in the different fields plowed. Some fields will be comparatively large, level and well suited to steam plowing, while others will be small, difficult to reach, probably wet in places, and perhaps covered with rice dikes or old cane ridges which, in many cases, run at right angles to the direction of the plow, necessitating a reduction in speed and a waste of valuable time. Furthermore, the fields may be filled with ant mounds, hidden stumps, small trees, etc., all of which should be removed before taking the plow to the field.

The heavy engine is much more expensive to move from field to field, its excessive weight causing it to sink in soft places. The large plow will also come in contact with more stumps and roots, causing a greater percentage of breakage than the small one. This breakage is charged to the land plowed under the head of "repairs." Rough land causes more damage to the heavy engine owing to the fact that the bolts loosen on account of the jar in passing over the obstructions.

The smaller engine is much more economical due to the ease with which it can be turned around in small fields.

The farmer who owns a steam plow has a decided advantage over the Government in being able to use his labor at other work on the farm when not employed in steam plowing. The Government is required to pay its men during bad weather and while the engine is laid up on account of breakages, etc.

The 22-horsepower engine and the 8-disk V-shaped plow were taken to the Imus Estate the latter part of March, but owing to the lateness of the season and to the fact that the land had not been properly prepared, very little was accomplished.

The 22-horsepower Hart-Parr petroleum-burning engine was taken to the Alabang stock farm the latter part of May. This being a new engine it was necessary to do some experimenting before any steady work could be undertaken. It was, therefore, used for hauling and plowing for several days; the rains, however, interfered with any extensive operations. A short test was made of the amount of fuel consumed, which seemed to show that it consumed about 3½ gallons of petroleum per hour. The test was satisfactory in every way, both as to hauling and plowing. While this engine weighs 9½ tons, yet it is very easy to handle on ordinary sod land. All indications point to this as the coming traction engine for use in those districts where fuel and water are difficult to obtain.

PREPARATION OF FIELDS.

Many farmers desiring to have steam plowing done still neglect to have the fields properly prepared before asking that the plows be sent to their farms. The labor furnished by the land owner to supply fuel and water for the engine is, in many cases, very unsatisfactory.

Many farmers seem to think that the plow is a stump puller and instead of grubbing up trees 10 inches below the surface of the ground, as they have been instructed to do, will cut them off even with the surface. The engineer is unable to see these stumps and broken disks are the result, causing delay in securing castings from Manila, to say nothing of the expense of same. Some farmers after six months' notice wait until the plow arrives before they begin grubbing stumps and trees, leveling ant mounds, etc. It is only fair to say, however, that others give every assistance possible in the work by having the land properly prepared and fuel on the ground.

While it is not the policy of this Bureau to recommend burning any organic matter off the soil, we find it necessary to have the tall grass which grows on these semiwild lands burned, or otherwise removed, in order that the engineer may see the ant mounds, ditches, and other uneven places in the ground sufficiently in advance to avoid them.

Possibly the easiest way to do this is to pass a roller over it at the end of the rainy season, crushing the grass down so that it burns completely when fired.

FUEL.

In regard to fuel, it is recommended that no more coal be used in steam-plow work, and that every farmer who desires plowing done have wood cut at least six months in advance of the plowing season. In many cases "madre de cacao" can be secured in close proximity to the field and if this wood is cut a sufficient length of time before the plowing season it makes a better and very much cheaper fuel than coal. Its use will result in a saving of cost in plowing from ₱4 to ₱6 per hectare.

FIBER MACHINERY.

The Pioneer maguey machine referred to in our last report was experimented with and five improvements made on this machine. After these improvements were made a number of experimental tests were made in cleaning fiber, the results of which were fairly successful. The machine cleaned an excellent quality of fiber, but the quantity obtained in a given length of time was not entirely satisfactory. This machine was later sent to Vigan in the Province of Ilocos Sur where it was installed in the Trade School. The following report relative to the use of this machine in Vigan has been furnished by the division superintendent of schools in Ilocos Sur.

The maguey machine was sent to Vigan last January. It was set up and began work on the 17th of that month. It continued work until the 19th of February, ultimo. During this period the machine ran 140 hours on twenty-two different days and stripped 117,000 leaves, an average of 835 leaves per hour. This resulted in 1,572 pounds of clean fiber. The labor exclusive of the man in charge amounted to ₱42.45 and the fuel for the engine cost ₱59. The per cent of fiber obtained is 4, and the waste amounted to 95 per cent.

The principal maguey growers of Ilocos Sur brought leaves to be stripped and saw the machine in operation. It demonstrated to them that a machine can strip maguey and strip it successfully. In this respect the experiment has been a success. But the capacity of the machine is too small to make it a commercial success. In this respect the machine has been a failure.

One of the smaller Prieto fiber-cleaning machines has been received from the United States but has not yet been put into operation.

CORN GRINDING.

A Kelly duplex feed grinding mill ordered by the Bureau has been at the Singalong experiment station during the year. This mill has a capacity for grinding about 18 cavans of ear corn per hour and is operated with an 8-horsepower Altman-Taylor portable steam engine. We have ground a total of 170,538 pounds of corn, sending some to the stock farms at Alabang and Trinidad, and some to the serum

laboratory at San Lazaro. A test to determine the cost of grinding ear corn with this mill was made on June 1, 1908, with the following results:

Time in operation, 3 hours, 5 minutes.
Weight of corn and cob meal, 6,137 pounds.
Labor used:

Four men, at 10 centavos per hour	₱1.23
Two men, at 12½ centavos per hour	.77
Coal used, 436 pounds at 80 centavos per hundredweight	3.48
Total expense of grinding 6,137 pounds	5.48

The cost, as shown by this test, without figuring interest on capital invested and wear of machinery, was a little more than 9 cents per hundredweight. The conditions under which this test was made were, however, very favorable, and the run made was an unusually good one.

PUMP AND BOILER.

An upright boiler and a steam pump have been installed at the Alabang stock farm to pump water for irrigation and stock use; also, the steam hay press was taken to the same station and used in baling straw purchased for the use of the stock during the rainy season.

SMALL PLOWS.

An assortment of small plows cutting from 5 to 6½ inches was purchased with a view of trying them in the various kinds of soils found in the Islands, and the plows found to work well in certain soils will be recommended to firms importing implements. There is a large demand for good, small plows which one vaca or carabao can pull. The kinds that have been imported heretofore have not been adapted to conditions existing here. When the right kinds of plows are imported they will find ready sale and do a much better class of work than the native plow now in general use in the Islands.

DIVISION OF PLANT INDUSTRY.

This division includes all general plant investigation, seed distribution, laboratory and field test of seeds and the work at the experiment stations located as follows:

Singalong.—Located in the southern part of Manila on sandy soil at sea level.

Baguio.—Located at Baguio, Benguet Province, at an elevation of 1,500 meters on drift soil, rather poor in plant food.

There are also two substations located on the west side of the mountain range between Baguio and sea level, for purpose of testing crops at various altitudes.

Lamao.—Located on Lamao forest reserve in Bataan Province. This

station is also at sea level. The soil is mixed sand and clay of average fertility.

La Granja modela.—This is the old Spanish experiment station near La Carlota, Occidental Negros, and is devoted largely to growing cane.

Lipa.—Located near Lipa, Batangas Province, in the coffee district. Nothing but coffee is grown at this station.

PLANT INVESTIGATIONS.

ABACÁ.

Work during the past year with this fibrous plant has been limited to the propagation from seeds and owing to the difficulties experienced in securing good, viable seed for planting, results have not been especially favorable. Some plantings failed entirely. One lot, coming to us under the variety name of Large Sorsogon, germinated nicely, but proved to be not abacá but "wild banana," a practically worthless species found in waste places and without cultivation in many parts of the hemp-producing districts.

The two small plantings at Singalong that proved successful have furnished about 1,500 seedlings which are now growing nicely under shade. Plants from the first planting made in July, 1907, stand from 1.3 meters to 2 meters in height, the measurements being taken to the top of the erect growing leaves. There is now an average of more than three suckers springing from the roots of these plants.

"Abacá blanca" is the name of a variety coming from Casiguran, Sorsogon, and planted in the seed bed November 6, 1907. These were grown under shade and on March 26, 1908, while not nearly so large as those from the early planting, were beginning to sucker.

A similar test was made at Lamao station, where, after growing the plants under shade until they were from 18 to 24 centimeters high, they were transplanted to the open field. About 20 per cent of these transplanted plants died from the effect of the exposure. It was noticed that the smaller plants suffered more than the larger ones. They all made slow growth for the first two months, after which growth was more vigorous and the plants are now very promising.

About 3,000 plants are available for distribution from this planting.

At La Granja, Occidental Negros, plantings were made in a similar way and with the same kind of seed. From 0.75 kilogram of seed 2,000 plants are available for distribution.

An attempt was also made at this station to grow abacá from seed by sowing it between rows of growing cane, but it was found that when the cane was removed the young plants died from exposure to the sun.

From experiments so far it is deemed advisable that in case it is desired to grow abacá from seed that a shade be constructed of bamboo

so as to give about one-half shade to the plants growing under it. With a thoroughly prepared seed bed and with proper attention as to watering, etc., plants can be grown very successfully in this way and be ready for transplanting in from four to six months.

Considerable difficulty has been experienced in securing seed that would germinate. Germination tests of various samples of seed received range from 2 to 80 per cent. Care should be taken not to secure seed from unripe plants as the per cent of germination is usually very low.

MAGUEY.

Work with maguey during the past year has been confined largely to the distribution of sucker and pole plants, both native and Hawaiian. Interest in this crop continues unabated and requests for plants have ranged from one to thirty thousand from individuals and governors of provinces. More than two-thirds of the plants distributed have been what is known as pole plants.

About 67,000 of these pole plants, arriving from Honolulu in a very dry, wilted condition, were planted in a nursery at Singalong in July, 1907, in order to ascertain the probable growth of these plants during the first year. These plants were set in rows 50 centimeters apart with 24 centimeters between plants in the row. They occupied a total area of 7,000 square meters. On June 30, 1908, many of these plants had reached the height of from 42 to 66 centimeters. Some are producing suckers. These plants have been distributed as the other plants.

The total number of maguey plants distributed during the year is given in the table of seed distribution elsewhere in this report.

Three hundred and fifty thousand native pole plants were grown in nursery at the Lamao forest reserve. A large per cent of these plants have been distributed during the past year, but we still have on hand for distribution at this place something over 150,000 plants.

A field containing 2.5 hectares was planted in both native and Hawaiian maguey at Lamao station in order to test the feasibility of planting maguey among the stumps after the trees and brush had been removed by cutting and burning. These plants have made normal growth, some Hawaiian plants having leaves 1.3 meters long, but require considerable expense in cutting down the brush and weeds each season.

The field of 2 hectares of Hawaiian maguey, planted on the high, rolling land at La Granja, Occidental Negros, October 27, 1906, has developed very uniformly, producing leaves 1 meter long, and in another year will be ready for cleaning tests. It is estimated that 10,000 sucker plants can be obtained from this field now for distribution. The area of maguey is gradually being extended at this farm.

The 336,000 native pole plants from Ilocos Norte, set in nursery at La Granja on November 6, 1907, are now ready for distribution.

KAPOK.

During the past year kapok seed has been planted at Singalong, Lamao, and La Granja for the purpose of securing young trees for distribution. There are now available for distribution at the various experiment stations two and one-half million seedling trees. Although we have advertised that these trees are available for distribution very few requests have been received for seedlings.

Experiments have been begun at Lamao and Alabang to show the relative value of the various methods of securing kapok trees, namely, from the seedlings and truncheons. As it will be some years before these trees will come into bearing, no report can be made as to the probable value of either method.

Data have been collected by representatives of the Bureau in various provinces on the yield of kapok trees, both wild and cultivated. Very few reports show that the trees are cultivated to any extent at all. Most of the reports are on trees growing either wild or in fence rows. A total of 448 trees have been reported upon, but as the figures cover a period of only one year the work will be continued for at least two years longer.

RUBBER.

Four species of rubber plants are in cultivation at Singalong. They are *Hevea brasiliensis, Castilloa elastica, Manihot glaziovii,* and *Criptostagia grandiflora,* the last-mentioned species being a wild native vine. Four *Hevea brasilienses,* or Para rubber seedlings, planted almost four years ago were measured on June 2, 1908. The circumferences were taken 1 meter above the ground. Girth measurements are given in centimeters and height in meters.

	Circumference (centimeters).	Height (meters).
No. 1	25	6.0
No. 2	28	7.0
No. 3	27	6.6
No. 4	31	7.0

Five seedlings of *Castilloa elastica* planted at the same time were also measured on the above date in the same manner as the Para rubber and showed the following dimensions:

	Circumference (centimeters).	Height (meters).
No. 1	37	5.0
No. 2	36	4.6
No. 3	45	5.3
No. 4	33	4.0
No. 5:		
(1)	28	4.0
(2)	30	4.0

These trees have not rooted well and consequently have blown down during heavy typhoons. This is not surprising, however, when it is remembered that this rubber requires certain elevation above sea level and that the elevation at which it is growing here is about 1 meter. During the past year these trees have produced seed.

About 100 trees of Ceara rubber, ranging in height from 10 to 12 meters, now growing at La Granja experiment station in Occidental Negros, are producing seeds in large quantities. Many thousand seeds have been distributed to persons interested in this species of rubber plant.

The area is being extended by planting truncheons and seed, so that in a short time sufficient area will be secured to make a test of this rubber on a commercial basis.

FIELD CROPS.

CORN.

Seed of a native white variety was obtained from Batangas and planted at Singalong January 6, 1908, with the object of determining its yield of green fodder. The seed proved weak, and on January 22 only about 20 per cent had sprouted. Replanting was resorted to and a fair stand obtained. The stalks grew quickly and attained a height of about 2.15 meters. It made excellent fodder, many small ears adding to its value. The ears filled out fairly well, but were seriously damaged by a small cut-worm (lepidopterous) which resembles the cotton boll-worm. The crop was cut March 18 and amounted to 2,492 kilos, equivalent to 14,459 kilos per hectare.

A small planting of Longfellow variety, seed of which was introduced from the United States, proved a failure. Stalk development was very weak and the small amount of corn produced was light, chaffy, and of very poor quality.

Seed of the large Mexican June corn recently introduced from the United States and sent to this station for trial was planted and the corn is now growing nicely.

At Lamao a trial test was made of "Longfellow" in comparison with native corn grown in the vicinity of the Lamao forest reserve. The "Longfellow" came in flower some two weeks in advance of the native variety and ripened in seventy-two days. The yield was comparatively small but promising. At this station a test was also made of a variety of sweet corn known as "Sanford." This variety does not have the appearance of sweet corn, but seems to carry more sugar than the ordinary field corn and is quite valuable for table use. The ears are quite long and cylindrical, filling out well toward the end. This is perhaps the most promising variety of sweet corn tested at this station so far. It matured in seventy-one days. Enough seed was saved of this to plant quite a large area the coming season, in order that we may have seed for distribution.

A test was made of early Crosby sweet corn at La Carlota to determine its value as table corn. The development of the corn was very poor and no ears of sufficient size to be of use were produced. This is probably due to the fact that sweet corn is native to cold climate and it does not thrive where the temperature is high during the early period of growth.

A test of early Crosby made at Sablan, a substation of Baguio, located at an elevation of 600 meters, gave excellent results. The corn grown was in every way equal to corn grown in the United States.

ALFALFA.

Small plats, 2 by 10 meters, of English and Turkestan alfalfa were sown at Singalong in December, 1907, and have produced two good cuttings. Ten pounds of inoculated soil, which had been introduced from the United States, was worked into the ground at the time of seeding and resulted in the development of an abundance of large nodules upon the roots of the young plants. Growth was rapid, but while the plants increased in height they showed a decided weakness of the stem, a defect which caused much of the first crop to lodge. Blossoms were very sparsely borne. The number of plants in bloom at any one time did not exceed 3 per cent of the stand, though cutting was delayed more than eight weeks after the first flowers appeared. The few seeds that set failed to mature. Conclusions as to the results of the trial can not be drawn until the effects of wet weather upon the crop are learned. Previous experiments have given considerable encouragement during the dry period, but utterly failed upon the advent of wet weather.

Alfalfa has been grown at Baguio for some years in an experimental way, using seed from various sources. Although no inoculation was given to the soil the plants produced a few nodules, but the results as a whole have not been promising. The plants would grow well for short periods and then seem to die out. A few blooms have appeared on the plants, but so far no seeds have been secured.

A small plat was planted in alfalfa at Alabang on stiff clay soil, but the plants did not seem to thrive well, although the land was inoculated with soil obtained from California. The plants soon died out and the plat was overgrown with grass and weeds.

SUNN HEMP.

Tests made with this legume (*Crotalaria juncia*) have developed some interesting facts. Plants grown from a few seeds planted in drills October 23, 1907, attracted attention on account of their prolific seeding habits, and a more extensive planting was planned.

On February 4, 1908, a plat measuring 364.5 square meters was planted in rows 0.5 of a meter apart. The crop was produced with just one hoeing and one irrigation which, from later appearances, was unnecessary.

Cutting was completed May 20, 1908, and a yield of seed secured equal to 2,395 kilos of seed per hectare.

A small quantity of seed was run through a corn-grinding mill and the product screened through a close-meshed wire screen, thus separating the smaller particles or bean meal from the larger, or bean hulls. The bean meal constitutes 70 per cent and the bean hulls 30 per cent of the total weight. Samples furnished the Bureau of Science showed the following analysis:

Contents.	Meal (per cent).	Hulls (per cent).
Moisture	9.66	12.42
Ash	6.72	4.88
Protein	43.86	9.81
Nitrogen-free extract	28.06	54.52
Crude fiber	7.86	17.37
Ether extract	3.84	1.00

Some of this ground seed was fed to stock in small quantities, but tests have not been sufficiently extensive to justify any positive assertions in regard to its possibilities as a stock feed. Horses did not seem to relish it when fed alone, but when mixed with an equal part of oats or Indian crushed feed, they ate it fairly well. Cattle ate the bean meal greedily at first but seemed to tire of it in two or three feedings. Bean meal was also fed to hogs at various times and was always eaten readily, but owing to a lack of feed in sufficient quantities no systematic feeding tests have been made.

COWPEAS.

The so-called Venezuela black bean has been grown again at Singalong during the past year and has produced a heavy yield of seed and a rank growth of vine. The planting was made on January 13 and seeds first ripened March 30, just eleven weeks after planting. A native "sitao," or cowpea, was also planted, but it proved less productive, both of seed and vine growth, than the Venezuela black bean. Both cowpeas have been attacked by aphids which did much damage and at one time threatened to ruin the crop.

VELVET BEANS.

A small plat of the Lyon velvet bean was planted at Singalong on January 11, 1908, and five months later a crop of seed yielding at the rate of 2,200 kilos per hectare was harvested. These beans are inclosed in a thick fleshy pod which, upon reaching maturity, shrivels up and becomes very tough and leathery. A separation of the beans from the pods is effected with difficulty without machinery. In our work with this bean during the present year the crop did not mature until the rains began and many beans decayed and were lost from contact with

the wet ground. To eliminate dangers from loss through these causes, an earlier season of planting is recommended.

An uncultivated black velvet bean was planted at the same time and in the same manner as the Lyon bean. In vine growth it is decidedly outstripped by the Lyon bean, but after six months' growth it has failed to set a single flower.

The Florida velvet bean has been used at Alabang as a forage crop only. No attempt has been made to obtain a yield of beans. It has been grown with either sorghum or teosinte in order to make a mixed forage for feeding the live stock. It grows fairly well on this stiff soil and makes a greater amount of green forage per acre than any other leguminous plant.

NATIVE LEGUMES.

A number of native legumes have been collected and tested at Singalong to ascertain their value for forage or cover crops. Those most promising are *Tephrosia luzonensis, Indigofera hirsuta, Phaseolus semierectus* L., *Crotalaria incana* and *Abyscicarpus vaginalis.* All of these were found growing in an uncultivated state.

I. hirsuta, P. semierectus L., and *O. incana* were not eaten by horses and cattle. *T. luzonensis* was eaten rather indifferently by both horses and cattle. A marked improvement in the vigor and robustness of this latter plant has been brought about by cultivation. *A. vaginalis* or manimani, is the most promising of all the species included in the test. All classes of live stock eat it readily. Growing wild it springs up among cogon or other weeds and attains a height of from 0.75 to 1 meter. At Singalong it has not shown an upright habit of growth, but planted on clean ground it has taken the form of a trailing plant with recumbent stems. It is not only resistant to long continued drought, but will live through excessively wet periods even in poorly drained locations where alfalfa, for example, would undoubtedly be lost. This little plant promises well as a pasture crop and will probably prove of considerable agricultural value if introduced into general cultivation. Seeds in quantities sufficient for making more extensive plantings of this legume are now available and it is hoped to continue the work during the coming year.

GUINEA GRASS.

Prior to January 1, 1908, field space and plants in sufficient amounts had not been available for planting a large area in this grass at any one time and consequently no definite yield tests had been made. About the beginning of the calendar year it was found possible to start a test along this line and 3,026 square meters were planted at Singalong during the first week in January. The system of planting in rows one meter apart and having half a meter between plants in the row was adopted. This method allows plenty of space between the rows for

irrigation, horse cultivation, and the application of fertilizers. Four good cuttings have been removed from this field during the first six months after planting.

The following table shows the growing period in days, yield, total expense, and cost per 100 kilos of each crop:

	Growth (days).	Yield. (kilos.)	Cost.	Cost per 100 kilos.
First cutting	66	4,278	₱26.50	₱0.62
Second cutting	42	4,640	18.17	0.39
Third cutting	35	8,275	53.15	0.64
Fourth cutting	40	4,350	6.22	0.14
Total	183	21,543	104.04	

The total yield during a period of one hundred and eighty-three days was, as shown in the table, 21,543 kilos, or equivalent to 78 tons of green grass per hectare.

Another plat containing 2,533 square meters, was planted during the first week in April. This crop followed corn, and received one light irrigation but no fertilizer. The crop cut during the first week in June weighed 9,455 kilos, or, otherwise expressed, produced the remarkable yield of 41 tons per hectare during a period of sixty-one days.

Roots of this grass were sent to Baguio about January 1, 1908, and immediately transplanted. Owing to the comparatively poor soil and cold climate it does not reach its fullest development there, but a few plants set out at Naguilian are doing extremely well, reaching a height of 2 meters and showing every evidence that the grass will grow under conditions existing at that station.

At the Lamao forest reserve this grass has proved as valuable as it has in Manila.

A few Guinea grass roots were sent to Alabang in December, 1907, and transplanted on the low, heavy rice land, but it did not succeed under these conditions owing probably to the extreme stiffness of the soil. Later it was transplanted on the hillside where it gave better results. A sufficient area has not been secured as yet to make tests of the actual yield.

The area devoted to this crop at Singalong has furnished material for liberal feedings of stock, both here and at the serum laboratory, and good results have always followed its use. It is extremely palatable, horses, cattle, goats, hogs, Guinea pigs, and rabbits eating it with relish, and chickens from the near-by barrios have shown a fondness for it by persistently eating off the young, tender blades.

A practical test of the feed value of Guinea grass was made in cooperation with the office of land transportation, quartermaster's depart-

ment, which extended over a period of two months. Four lots were fed as follows:

(1) Three horses were fed each 7.5 kilos of Guinea grass, 3.1 kilos of hay, and 2 kilos of oats;

(2) Three horses were fed each 15 kilos of Guinea grass and 4.1 kilos of oats;

(3) Three horses were fed each 5.1 kilos of Guinea grass, 4.2 kilos of hay, and 4.1 kilos of oats;

(4) One horse was fed Guinea grass only.

The results of this experiment as reported by that Department are as follows:

(1) The horses showed sluggishness and falling off in weight;

(2) The horses showed sluggishness and seemed to lose weight for the first ten days, after which they gained in flesh and had a better look and appearance, finally getting back to their normal weight;

(3) The horses seemed to do well, showing no signs of weakness or falling off in flesh. They worked full time at heavy draft work;

(4) For the first twenty days the horse showed weakness and falling off in flesh, bowels in laxative condition, improving later to some extent, not seeming strong, yet doing the work.

It is evident that the third lot of horses gave the most satisfactory results and made good use of the grass furnished. It must be remembered that in feeding work horses doing heavy work it is necessary that they have a large percentage of dry feed. A horse is not so constituted that he can use large quantities of watery feed and still do heavy work, as can the carabao or bull.

Several feed tests have been made in a small way at Singalong, and have proved satisfactory in every way. A small quantity of hay was made from this grass and fed to the ponies used at the station with good results, the ponies eating it with as much relish as they did the best timothy hay.

Our work with Guinea grass during the past year has developed the following facts concerning its growth and habits under local conditions: It requires rather a high temperature, plenty of sunshine, and a soil that while moist is not too wet. An excessively wet or saturated soil is undesirable and standing water will soon kill the plants.

Guinea grass has seeded freely during all seasons of the year. The seeds ripen very irregularly and the first to ripen fall before the others have matured. Many of the seeds will germinate if the grass is cut and cured at the time the first seeds begin to fall. Care should be taken to prevent waste of seeds, which loosen and drop from the panicle as soon as a dry or cured condition of the grass is reached. It is advised that the field be gone over every few days and the heads cut and saved as they ripen.

This grass has been distributed to all of our experiment stations and in a very short time the Bureau will be able to furnish those who desire a start of this grass with either seeds or roots from these points.

Nearly 70,000 roots of this grass have been distributed during the past year to farmers and others interested in the growing of this grass. In fact, the demand has been much greater than we have been able to supply. Some request as much as 20,000 to 30,000 roots at a time, but the Bureau with its present supply can furnish only small quantities to individual farmers, which will enable them to get a start of this grass by root division, as it stools rapidly. The area can also be increased rapidly, in a comparatively short time, if it is allowed to go to seed and the seed heads gathered as they ripen, and immediately planted, by thoroughly preparing the seed bed, destroying the weeds, etc., then sowing the seed and raking it in lightly just previous to a rain, or irrigation, if this can be had.

PASPALUM DILATATUM.

This large water grass grows in low spreading bunches, produces dense masses of succulent root leaves, and is admirably adapted for pasture purposes. A planting at Singalong made from root divisions during the first week in January endured the entire dry season without irrigation. *Paspalum dilatatum* springs up quickly after harvesting, but since its province is not that of a soiling crop, no regular cuttings have been made.

TEOSINTE.

A plat 150 square meters in extent was grown at Singalong during the wet season as a test of seed production. This was planted on May 28, 1907, and when cut on November 6 yielded at the rate of 1,166 kilos of good, well-matured seed per hectare. In addition to this amount, 35 per cent (by bulk) of the product failed to mature and was thrown away as worthless. On November 16 another planting of 265 square meters was made. The seed of this crop matured almost perfectly, the yield amounting to 1,590 kilos per hectare. Another experiment was conducted with teosinte within the year to determine its value for green-forage production. This work was begun on January 7 on an area of 852 square meters. The results of this trial are recorded in the following table:

Crop.	Time (days).	Kilos per hectare.
First	69	9,810
Second	43	25,513
Third	29	26,990
Total	141	62,313

An application of stable manure at the rate of 25 loads per hectare was plowed under at planting but no fertilizer was used on succeeding crops. On good fertile soil and with plenty of water for irrigation, teosinte will produce a remarkably heavy yield of a very succulent green feed. As compared to Guinea grass teosinte has produced slightly heavier yields for the first three crops, but at the expiration of that time the stubble has become hard and woody and growth has started reluctantly or failed entirely. On the other hand Guinea grass has produced large root bunches at this time and will continue to produce heavy yields for many months.

The grass is better liked by stock and is more nutritious than teosinte. The latter has the advantage of being propagated quickly from seed, a feature that not only reduces the expense of planting but also renders possible the immediate cultivation of large areas in remote places where grass roots are not available.

RICE.

A comparative test of five varieties of mountain rice was conducted at Singalong during the early part of the year. Seed for making the planting, consisting of ypotylon, malinga, macan, sinampablo, and pinursigui, was obtained through the courtesy of Governor Knight, of Nueva Vizcaya. Palay was sown in the seed bed on June 20, 1907, and on July 20 the plants were set permanently in the field. Irrigation was given only at times of seeding and transplanting.

The following table shows the date of harvest, period in days from seeding to harvest, and yield per hectare:

Variety.	Date of harvest.	Days.	Kilos per hectare.
Ypotylon	December 12	175	1,682
Malinga	December 12	175	2,432
Macan	December 17	180	1,752
Sinampablo	October 28	131	2,000
Pinursigui	October 25	128	2,740

Pinursigui has made the most favorable showing of all varieties represented in the test. Immediately after this variety was harvested a heavy rain fell causing a second growth of palay to start. This crop matured and was cut on December 17, adding 25 kilos to the original yield, making the total yield 2,765 kilos per hectare. Ypotylon and malinga were both badly damaged by chickens feeding upon the grain before harvest. Malinga promised well and it is thought might have surpassed pinursigui in yield had it not been for the persistent attacks of these fowls. Granting this, however, pinursigui may still claim the advantages of a short season.

BEETS.

Very gratifying results have attended our work with this vegetable at Singalong. Seeds drilled on November 15, 1907, produced nice large beets in seventy-five days. Many of them weighed as much as 0.5 kilo each, the largest weighed nearly 1 kilo. Bassano's extra early turnip easily surpassed all others in size, uniformity, and productivity. For table use it is perhaps as sweet and tender as any beet grown, but unfortunately it is light red, ringed, or white in color. Lentz and Eclipse made the best showing among the red beets tested. Crimson Globe and Crosby's imported Egyptian did fairly well, but were not equal to Lentz and Eclipse. Egyptian extra early turnip and Detroit dark red turnip are small and under conditions of the test did not prove to be desirable varieties. Half long blood and long blood red are late maturing varieties of good eating quality and color. Both have long, branching, irregular roots and can not be classed as fancy beets. Bassano's extra early turnip produced 24 kilos of beets on a row 15.5 meters long, not a large, but a good yield in most sections of the United States.

CABBAGE.

A test of varieties of cabbage was made at Singalong, but owing to the fact that seed was not sown until November 14, 1907, this experiment extended into the hot, dry season and consequently indifferent results followed. Remarkably rapid growth was made during January and the first half of February, but at the time the heads began to form, the heated condition of the soil caused the plants to wilt during mid-day hours and arrested the development of the heads. Frequent irrigations were given at this time with a view to protecting the plants by reducing the intense heat of the soil. The refreshing effect of these irrigations upon the plants was very noticeable. A test in which 40 plants of each variety were set out on January 10, 1908, gave the results recorded in the following table:

Variety.	Number grown.	Number headed.	Total weight (kilos).	Weight of largest (kilos).
Winningstadt	36	24	10	0.8
Bloomsdale large late flat Dutch	32	25	12	1.0
Landreth's very early	33	27	19	1.4
Bloomsdale early dwarf	32	26	12.8	0.9
Reedland's early drumhead	38	26	28.6	2.3
Danish ball head or Holland	21	18	10	0.9
Landreth's 100-day	36	27	15.9	1.0
Jersey Wakefield	32	27	12.8	1.2
Landreth's earliest Savoy	18	13	13.2	1.3
Total	278	213	134.3	

This very poor showing can not be taken as illustrative of what may be expected from cabbage culture in Manila. Had this work been begun six weeks earlier the advantages of cooler weather for field growing should have given more favorable results.

Cabbage has also been tested at Lamao but the plants were destroyed by worms, ants, and other insects so that no data were secured on the crop grown there.

SWEET POTATOES.

Twenty-six tubers of a variety of sweet potatoes were introduced from the southern part of the United States and sent to Singalong on November 6 for planting. Plants propagated from these tubers and planted in the field on November 27 developed a very vigorous vine growth. The tubers, however, were attacked by a small, white, maggot-like larva in such numbers as to destroy the entire crop. This insect, *Cylas turcipennis* Bohem. (*Curculiondæ*), was identified by the Bureau of Science entomologist. It feeds first upon the surface and then bores deeper into the tuber, causing the total destruction of the latter before maturity is reached. Three different plantings on as many different plats have been under observation at the station during the year and all have been ruined by this borer.

TOMATOES.

A few plants of the Ponderosa variety were grown from seed introduced from California by Dr. Stevens, of Manila. These produced a remarkably vigorous vegetative growth but remained almost barren of fruit. The few tomatoes that did develop were of superior quality, but the number was small and it would not be a serious error to report the crop a total failure.

An attempt has also been made to grow tomatoes at the Lamao experiment station. The American varieties tested there have made excellent growth of vine, but refused to set fruit, as was mentioned regarding the tomatoes grown at Singalong. After the vines had reached considerable height they were attacked by a fungous disease and destroyed.

LETTUCE.

This has been one of the most successful crops grown at Singalong within the year. Seeds of six different varieties were sown in the seed bed on February 12, 1908; these varieties were prizehead, big Boston, early curled Simpson, Hanson, passion, and salamander. The seedlings were pricked out and potted to 2-inch pots during the last week in February and a week later were planted permanently in the field. Prizehead surpassed all other varieties in the test. Planted 30 centimeters apart in either direction the plants developed until they interlapped and completely

hid the ground upon which they were grown. The reddish curled leaves were extremely crisp and tender.

The following varieties were also planted at La Granja: Big Boston, prizehead, Hanson, early curled Simpson, and passion. After the plants had attained sufficient size they were transplanted into beds, as was done at Singalong. At this place prizehead and big Boston seemed to do better than the other varieties, yet they did not do as well as prizehead at Singalong.

At Lamao, Bataan Province, the same varieties were tested as at La Granja, and in a similar manner, except that tests were made by planting under half shade and in the open field. About the same space was given as mentioned for the other stations, with the results that under shade conditions early curled Simpson made a very favorable showing, maturing early and producing large, crisp heads from 33 to 36 centimeters in diameter, more or less compact. Passion ranks next in size of head and compactness, although it matures several days later. Under open field conditions big Boston gave the best results. It seems to withstand the hot sun and matures comparatively early, producing large heads. This is a semicurled variety and the heads are not as compact as in noncurling varieties. The other varieties gave fairly good results under field conditions.

In this climate lettuce should be planted so as to mature during the cool season, as warm weather tends to make the plants go to seed before the head has fully developed.

FRUITS.

AVOCADO.

There are several fairly thrifty trees of the alligator pear growing on the Singalong station grounds. These have grown and appeared vigorous and healthy throughout the year. The tree that bloomed last year flowered profusely again during the past season, but again it failed to set fruit.

Scale insects have been present on these trees in large numbers during the dry season.

The avocados growing at Lamao are making rapid growth of wood, but as yet none have flowered.

In view of the fact that only about 20 per cent of seedling trees bear fruit in any quantity, it will probably be necessary to import some budded or grafted trees of known bearing varieties.

GRAPES.

Two of nine vines of the Malaga variety growing at Singalong have matured fruit during the past season. This was the first fruit borne by these vines and only a few small bunches were produced. Another

variety of the zinfandel type is under cultivation here, but as yet it has failed to fruit.

During the past year several plants of the scuppernong grape, a variety grown extensively in the Southern States, were imported for test under climatic conditions here. This variety grows extremely well near the seacoast from Jamestown to Florida.

ORANGES.

The California orange trees planted at Singalong six years ago are fruiting fairly well during the present season. Six trees are fruiting and one of this number carries 92 oranges that are now nearing maturity. The fruit is smooth, well formed, and of good size.

The orange trees imported from California and Australia, growing at Baguio, are making fairly good growth and one naval orange tree is now bearing fruit.

KUMQUATS.

Five trees of this small citrus fruit have been grown under rather adverse conditions, but have fruited remarkably heavily and have continued to bear throughout the entire season.

BANANAS.

A small plantation including the varieties gloria, sabá, matabia, latundan, bongolan, lacatan and lacatan bula, was set out at Singalong on August 3, 1907. All varieties have made very satisfactory growth. Fruit of bongolan, latundan and the lacatan varieties has reached maturity. Matabia will, judging from present indications, ripen fruit by July 10, 1908. The cutting stage of gloria is still two months distant, while sabá, with its monster plant, 6 meters high and more than one-third meter in diameter near the ground, shows no evidence of fruiting. The Chinese dwarf banana has also been grown and it has produced large bunches of fruit which was at least well above the average in quality. Plants of this banana sustained much less damage from winds than did those of other varieties.

At Lamao experiment station experiments have been started to test the value of different fertilizers for use on bananas, as well as methods of cultivation, mulching and irrigation. Results will not be available from these experiments for two years at least.

MISCELLANEOUS.

LEMON GRASS.

The small area of this grass now in cultivation at Singalong is doing nicely. The original planting was made from two large root clumps brought here from Lamao by the Director of Agriculture, and subdivided for planting on November 6, making 110 plants. Three months

later these were almost as large individually as either of the original bunches. On February 6, twenty-one root divisions were received from Baguio and immediately planted in the field. These were prepared for shipment under direction of the Secretary of the Interior with a view to determining the vitality of the roots and their ability to grow and produce plants after shipping under unfavorable conditions. Before shipping, all roots were removed from thirteen of the plants, while eight divisions were allowed to retain their roots. Just one small, slender plant from which all roots had been cut failed to grow, indicating that these roots are signally tenacious of life. Very interesting variations in the habits of growth of the Bataan and Benguet grasses were observed soon after planting. Growth was at first much more rapid in the plants coming from Benguet than was the case in the plants from Bataan. The leaf sheath of the former was almost white, while that of the latter was a distinct purplish red. It was thought that two distinct varieties had been found, but later developments proved them identical. So far, neither yield tests to show the production from a given area nor analytical tests to determine its content of oil have been made.

A considerable amount of this grass is now growing at Lamao and is available for distribution.

VETIVER.

This stout-growing medicinal and perfume-yielding grass has made rapid growth at Singalong. From 330 roots sent to the station by the Secretary of the Interior during the second week in February, only 3, or less than 1 per cent, were lost in the process of planting. By the end of June this grass had developed a very strong system of tough, fibrous roots. The erect, growing, reed-like blades stood in dense masses 1.5 to 2 meters in height and flowering had just begun on June 30.

ROSELLE.

One row about 60 meters in length was drilled to this splendid jelly plant (*Hibiscus sabdarifa*) on January 31, 1908, and later the plants were thinned to about 1 meter apart. After five months of growth the plants are from 1.5 to 2 meters in height, are bushy and vigorous, but do not show indications of flowering.

SEED AND PLANT DISTRIBUTION.

It is the object of the Bureau in distributing seeds to furnish planters with sufficient seed, of such promising species and varieties as are not readily obtained elsewhere in the Islands, to give them a fair trial and if satisfactory provide a source from which they may collect their own seed for future crops. That interest in the extension of the number of crops that may be profitably cultivated here either for home consumption or for market has not in the least abated is clearly shown in the

following table giving the total distribution made during the fiscal year ending June 30, 1908:

Crop.	Year ending June—	
	1907.	1908.
Vegetables	3,763	8,600
Flowers	173	533
Maguey	220,000	1,465,115
Guinea grass		60,900
Mulberry		1,742
Other farm crops	2,184	6,531
Miscellaneous		487

FIELD CROPS.

The principal distribution of seeds of field crops has been confined to corn, cotton, Guinea grass, kapok, peanuts, rice, sesamum, maguey, and tobacco, but there is a constant and increasing demand for various other plants of economic importance such as a hardy variety of coffee, cacao, spices, rubber, and various fruits. The Guinea grass has attracted more attention than any other single crop excepting maguey, and during the past nine months 60,900 plants, enough to plant 24 hectares, have been propagated and sent out from Singalong.

MAGUEY.

During the past year some 42,475 plants and bulbils of Hawaiian maguey and 1,422,640 of Ilocano maguey have been distributed to thirty-two provinces. In many cases these have been delivered in large consignments to the governors of the provinces or other persons so situated as to be able to make the smaller distributions to individuals to the best advantage.

Taking into consideration the number of plants distributed last year and the number planted out at several of the stations of the Bureau for propagation, it would seem that very shortly others who wish to plant will be able to secure plants locally or from the stations of the Bureau, thus relieving the necessity of making further extensive purchases abroad, so that funds used heretofore for this purpose may be devoted to introducing and improving other valuable crops.

VEGETABLES.

As a result of previous years' experience, the number of varieties of vegetables distributed has been somewhat limited, and only such seeds are sent out as have given a fair success with ordinarily good cultivation. These consist of beans, beets, cabbage, carrot, corn (field), cucumber, eggplant, lettuce, mustard, okra, peas, pepper, radish, tomato, and turnip.

A number of reports indicate, as usual, that insects cause considerable trouble to young seedlings. In the case of cucumbers this can be largely overcome by placing a piece of mosquito net over the young plants, and

after they get too large for this, spray the leaves with some arsenous mixture, such as Paris green, or dusting the leaves thoroughly and frequently with air-slaked lime or wood ashes. In the case of many plants such as lettuce, cabbage, tomato, etc., that stand transplanting, the carrying away of seed by ants may be avoided by sowing the seeds in flats and transplanting to the field as soon as large enough to handle. A number of reports have indicated a lack of knowledge as to the use of the different vegetables after they are grown, and so it has been deemed advisable to combine with the instructions for planting, in the pamphlet sent out with the various collections of seed, simple instructions for the preparation and use of the vegetables.

FLOWERS.

While the distribution of flowers and seed of ornamental plants may not bring in direct financial returns it is considered that the general effect on the communities, where some attention is given to this side of gardening, is sufficiently beneficial to justify some attempt at keeping up with the demand for this class of seeds. During the past year three times the number of collections sent out the previous year were distributed, and a number of requests were not filled for lack of seed.

REQUESTS.

Many requests have been received, which, while they indicate a desire to obtain and plant better fruits and other crops, show a decided lack of information as to what fruits are desirable for this country. This particularly refers to continued applications for apples, plums, and such fruits of northern and temperate countries marked by decided winters during which the plants receive a complete rest which can not be obtained here, even though a decided dry season may tend to have somewhat the effect of a winter in causing the plants to become dormant. While varieties of these fruits more or less hardy to local conditions may be ultimately secured by breeding and selection, it is not advisable to make any general distributions at present, as it is almost sure to lead to discouragement through the repeated failures that must be expected.

Another feature of requests that is markedly noticeable at times is the large number received from school children who desire seed for planting in school gardens. This is an excellent move and one worthy of encouragement, but it is believed that much more satisfaction could be obtained and much needless expense spared if the teachers would make the request direct, stating the amount required for the ground they are expecting to cultivate, rather than requiring each student to obtain seed for his own small plot.

PLATE II. SUPERINTENDENT'S HOUSE AT SINGALONG.

EXPERIMENT STATIONS.

Heretofore much of the work at the various experiment stations has been of the nature of commercial crop growing and demonstration work, in which attempts have been made to show the farmer that certain crops could be grown and how to grow them. This work has its value, but properly belongs to agricultural extension work on account of its educational nature. It is the intention of the Bureau to continue this work in so far as it seems to be necessary in the absence of any other agency for carrying on the work, but more attention will be given to collecting, testing, and breeding native varieties of our various farm crops, as well as foreign crops, thought to be suitable to these Islands.

One line of work which the Bureau is planning to undertake this coming season, is the collecting and testing of the native varieties of rice. Many hundreds of the so-called varieties are grown in these Islands, some of which are superior to any foreign variety introduced. An attempt will be made to collect these and test them under various conditions and ascertain the best conditions suitable to their growth as well as to the value of fertilizer for the cheapest production.

Many varieties of corn are grown in various sections of these Islands, from which may be selected and improved a variety which should prove better than any of those introduced.

Work of this nature will be pushed as rapidly as funds at our disposal will permit.

Constant changes of the superintendents at these stations has interfered greatly with the work. The principal reason for these changes is the short term of service of these men and the fact that the Bureau is unable to raise their salaries in order to hold them.

In experiment station work it takes some time to get the work in hand and be able to reach any valuable results, owing to the fact that experiments must be run two or three years in order to duplicate the work and eliminate the effect of seasons. These frequent changes have also made it difficult to secure complete notes on many of the experiments under way. It is also difficult to find men adapted to this kind of work, just as in any other business.

As the work grows older and becomes better organized, it is hoped that these difficulties will disappear.

SINGALONG EXPERIMENT STATION.

The work at the Singalong experiment station was in charge of Mr. Harold B. Ross up to October 7, 1907, at which time he resigned, and Mr. J. B. Thompson has since had charge of the work.

LOCATION.

The Singalong experiment station is located in the southern part of Manila, about one-half kilometer distant from Manila Bay. The point at which Calle Wright terminates in Calle San Andres lies almost in the center of the grounds. The station comprises a little more than 4 hectares of land, including lawns, drives, and grounds occupied by buildings, corrals, etc. The soil is light and sandy. An estero, into which salt water from the bay enters at high tide, lies facing the grounds. The fact that many of our deep-rooting plants and trees have not produced good results is perhaps due in part to the presence of this salt water. The highest elevation of the station grounds does not exceed 2 meters.

WATER SUPPLY.

A 6-inch artesian well is the source of water used at Singalong. The water in this well rises to within 1 meter of the surface and is pumped into a 6,000-gallon tank, having an elevation of 8 meters, by means of a 6-inch duplex pump. On April 28, 1908, the only time during the past year, it was found necessary to suspend pumping operations for a few hours due to a failure in the water supply. The 8-horsepower steam engine previously used for pumping has been removed to the bodega for grinding corn, and a 20-horsepower electric motor installed in its place. This change facilitates irrigation by eliminating the waste of time consumed in generating a sufficient head of steam to operate the plant.

The pipe system through which water is carried to all parts of the grounds consists of a 3-inch pipe at the pressure tank, gradually decreasing to 1 inch at remote points of the system. Practically all irrigation is done through 1-inch hydrants or "turn-outs." The hourly cost of running this plant, without considering interest on the original investment, wear of machinery, or risk from accidents, is about ₱0.60.

EQUIPMENT.

Two good Kentucky mares are used at the station to perform all general farm and team work. Common farm implements, such as an escort wagon, stirring plow, steel harrow, five-tooth cultivator, wheel hoes, garden seed drills, and other hand implements have been provided.

LABOR.

Radical changes have been made during the year in that line of the work with which the employment of labor is concerned. Superintendent Ross carried into effect on August 1, 1907, a revised pay roll providing for a general reduction both in wages and in the amount of labor employed. This measure reduced our force from twenty-eight to eighteen laborers and decreased the average daily wage from ₱1.14 to ₱0.90. Despite these changes no difficulty has been experienced in securing

help when needed. The labor force here is composed largely of experienced men, who have been employed at the station for a period of two or more years. With a few exceptions they have rendered satisfactory and efficient service.

CLIMATE.

Weather conditions have been in some respects unusual. The wet season of 1907 was late in opening but continued correspondingly late in the fall. Due to this fact no general irrigation was demanded prior to the second week in February, and good rains on the 15th and 25th rendered further irrigation during that month unnecessary. Rain fell again on March 29, putting the soil in excellent condition. The wet season opened again on May 3, and since that time no irrigation has been needed. A typhoon struck Manila on October 26 and caused considerable damage to crops and plants growing at the station. Another, more severe and of longer duration, visited us on May 28 and 29, doing much damage to vegetation.

All things considered, weather conditions have been possibly more than usually favorable for a majority of the farm operations being performed.

DISPOSITION OF GREEN FORAGE AND SEEDS.

Forage-growing experiments conducted here and recorded elsewhere in this report have furnished an abundance of green feed for all live stock maintained at the station, besides a considerable surplus which has been delivered at San Lazaro for feeding to the serum herd. Guinea grass was also furnished the quartermaster's department for conducting a feeding experiment in which this grass was fed to horses. The following table shows the different feeds removed from Singalong since October 7, 1907:

	Quartermaster's department (kilos).	Serum laboratory (kilos).
Guinea grass	10,909	36,608
Teosinte		3,140
Green corn		1,950
Total	10,909	41,698

Making grand total of 52,607 kilos.

Seeds grown at this station have been sent to the office and turned over to the division of seed and plant industry for distribution. They have been furnished in comparatively small quantities. Among others were 1,985 kilos of palay, about 145 kilos of velvet beans, and 55 kilos of teosinte.

There is no fence surrounding these grounds hence it is impossible to grow many crops successfully owing to the depredations of animals such as dogs, hogs, and chickens, as well as people, trespassing on the land and destroying the value of experiments by carrying off the fruits and vegetables. Although a watchman is kept on the ground at night it is impossible to stop this vandalism.

SILK CULTURE.

Near the close of the last fiscal year this Bureau, in connection with the Bureau of Science, started a series of coöperative experiments in silk culture at Singalong.

This work has been under the direct supervision of Mr. W. Schultze, of the Bureau of Science, with Mr. José Dizon, of this Bureau, in charge of the feeding and care of the silkworms. Two men have been used for collecting leaves, which have been obtained both from the station grounds and in other parts of the city. Two girls are now employed in the silk house.

Owing to the fact that the supply of mulberry leaves has been limited, it has not been possible to carry on the experiment with more than about 11,000 worms for each generation. The supply of leaves consumed daily by the 11,000 worms varies according to their age, as follows:

	Kilos per day.
First age (from the first to the third day)	0.9
Second age (from the fourth to the fifth day)	1.4
Third age (from the sixth to the seventh day)	2.3
Fourth age (from the eighth to the tenth day)	11.4

During the four periods they consumed a total of 44.5 kilos of leaves, or an average of 11.1 kilos for each period.

As soon as the larvæ show a yellowish transparent color, they are placed in wire baskets filled either with rice straw, dry weeds, cogon, or broom corn; or in wooden baskets divided into sections by small bamboo sticks. Of the different materials used, broom corn has been found to give the best results as it causes less waste of silk than the other materials.

Three days after each generation is pupated the cocoons are sent to the Bureau of Science where they are prepared for spinning the silk. Before they are sent, 300 of the best cocoons are selected for breeding purposes. These latter are placed on three trays covered with paper, and in about ten days the moths emerge from the cocoons.

Breeding is allowed to take place at once, after which the females are placed on a piece of circular filter paper. One day after, the females lay their eggs.

With the exception of the first and second generations, at which

time the work was in the hands of the Bureau of Science, the number of cocoons obtained from June 1, 1907, to June 30, 1908, is as follows:

	Cocoons.
Third generation	1,670
Fourth generation	5,570
Fifth generation	11,320
Sixth generation	8,290
Seventh generation	11,343
Eighth generation	9,533
Ninth generation	11,768
Tenth generation	4,659
Eleventh generation	8,671
Total	72,824

During the month of June, 1908, a reeling machine and a roll upon which to wind the silk have been constructed, and the girls working in the silk house are now being taught to reel silk.

SALE OF SINGALONG STATION.

The Assembly passed an Act providing for the sale of Singalong experiment station and the work now carried on there will be moved to Alabang. The soil at Alabang is somewhat different from that at Singalong, containing more clay and being poorer in plant food owing to the fact that it has been in cultivation a number of years.

BAGUIO EXPERIMENT STATION.

The work at the Baguio experiment station was in charge of Mr. G. J. Petrelli from the beginning of the fiscal year to May 30, 1908, at which time he resigned and Mr. M. C. Merrill was placed in charge as acting superintendent.

LOCATION.

This station is located about 5 kilometers north of the town of Baguio in the Trinidad Valley, which is a crater-like depression drained by the Balili River, which passes through this valley. It bounds the farm on the east side, and makes its exit through a notch on the north side of the valley. The altitude of this section is approximately 1,500 meters.

SOIL.

The soil at this station is a sort of silt, alluvial loam and is very deep, having been formed by the erosion of the near-by limestone rocks and clay hills, and deposited by the Balili River, which is now cutting a meandering course through its former deposit. The soil is lacking in humus and is poor in plant food so that the use of commercial fertilizers and all the manure that is available is necessary for the production of crops.

CLIMATE.

As mentioned in our last report the temperature in this section reaches the frost line in midwinter and the rainy season is a little earlier than on the west coast of the Islands, that is, beginning in May and ending in October. On account of these facts this section of the Philippine Islands has given promise of growing successfully many fruits and vegetables adapted to semitropical conditions elsewhere, but not adapted to sea-level conditions here.

The fact that the summer capital has been established at Baguio and that there is considerable demand for fruits and vegetables during the dry season, especially during March, April, and May, has made it almost imperative that this station grow vegetables on a commercial basis to supply the demand at that time. This has interfered materially with strictly investigational work, and as soon as private parties can be induced to take up this line of work and supply the demand, vegetable growing on a commercial basis will be discontinued and the work confined more to investigational lines.

A heavy typhoon and rain on May 28 did considerable damage to young trees and vegetables.

WATER SUPPLY.

Irrigation is necessary during the greater part of the dry season. The water for this purpose is obtained from the Balili River at a point about one mile from the station, and is conducted to the farm in a small canal. The drainage of surplus water, as far as slope is concerned, is poor, the farm being so nearly level. The somewhat porous nature of the soil, however, renders underdrainage unnecessary.

LABOR.

Both men and women native laborers have been employed in the past. For the lighter grades of labor, the Igorot girls and women are probably just as efficient and satisfactory as the men, as they are inured to labor from childhood, and are therefore very muscular. The daily wage for each laborer averages about 50 centavos. The average number of laborers per day, during the past year, has been twenty-six.

OPERATIONS.

During the past year considerable work has been done in beautifying the ground and erecting buildings. A commodious house has been erected for the superintendent and officers in charge; roads have been laid out and graveled; and many ornamental plants have been set out.

Work has been confined largely to the testing of such vegetables and fruits as are suitable to existing climatic conditions. Many thousand strawberry plants have been grown for distribution to parties who wish them. Some forage crops have been tested, but owing to the cool climate and rather poor soil conditions, satisfactory results have not been ob-

tained. Experiments in crossbreeding and seed selection of varieties of tobacco have been carried on at the substations Sablan and Naguilian during the year. Seeds were saved from many of the most promising plants and distributed to other sections of the Islands.

Owing to change of management of the station during the year, complete data on many of these experiments can not be obtained.

The apple, quince and loquot trees growing at this station are doing fairly well, but as yet no fruit has been secured. One peach tree has borne fruit, but the fruit was of poor quality, lacking flavor. One small fig tree is now bearing fruit, and an attempt will be made to propagate more extensively. A native variety of raspberry has been propagated which produces a large, highly colored fruit, but lacking in flavor. Imported varieties have not done so well as native varieties.

LAMAO EXPERIMENT STATION.

The work at the Lamao station was in charge of Mr. H. C. Cuzner up to October 1, 1907, at which time he was promoted to agricultural explorer and Mr. R. L. Clute placed in charge. Mr. Clute transferred to the veterinary division on January 1, 1908, and was succeeded by Mr. H. E. Stevens.

LOCATION.

The Lamao experiment station is located on the Lamao forest reserve, near Manila Bay, on the Lamao River, in Bataan Province. Most of the land now in cultivation is broken and hilly.

SOIL.

The soil is underlaid with drift bowlders, cobble stones, and large gravel, and varies from red clay to beach sand, including all varieties of sandy loam. It has evidently been formed by washings from the mountain sides. In many places it is so porous that it is difficult to conduct an irrigating ditch across it without puddling the ditch or fluming. Most of the land was originally covered with forest which makes it rather difficult to bring the land into cultivation. The fertility, however, is somewhat above that of the other farms, owing to the fact that it has never been cropped and the fertility removed.

CLIMATE.

The climate at this station is very similar to that in Manila, except that showers are more frequent, on account of its being near Mariveles Mountain.

WATER SUPPLY.

This station is well supplied with water by an irrigation ditch taken from the Lamao River. This river supplies an abundance of water at all times, and all that is necessary to secure it is to build a dam of bowlders across the stream in the dry season in order to run the water into the irrigation ditch.

LABOR.

Some difficulty has been experienced in securing good labor during the past year, owing to the presence of a sawmill in the vicinity of the station which pays higher wages than was paid at the station. It was found necessary to increase the wages from ₱0.60 a day to ₱0.75 in order to secure the necessary labor.

BUILDINGS AND EQUIPMENT.

Little has been done in the way of building at this station owing to the fact that no live stock is kept there except the work animals, and only a few buildings are necessary. The superintendent's house has been finished, and now suitable quarters can be had for scientific workers and investigators who wish to stop there for a limited time.

The equipment of the station consists mainly of hand tools and a few plows that are used in cultivating the crops.

OPERATIONS.

The work at this station has been confined largely to the testing of vegetables, growing of nursery plants of kapok, abacá, maguey, bananas, and pineapples. Many other tropical fruits have been sent there for trial but as yet no report can be made upon them.

INSECT PESTS AND PLANT DISEASES.

Plant diseases have done considerable damage to vegetables during the past year.

In May a swarm of locusts appeared and did considerable damage to corn and other crops growing on the place.

LA CARLOTA SUGAR FARM.

The work at the La Carlota sugar farm has been in charge of Mr. H. J. Gallagher since April, 1905.

LOCATION.

This farm is located at the foot of the volcano Canlaon, about 6 kilometers east of the town of La Carlota, Occidental Negros. It was established by the Spanish Government as a sugar experiment station, but so far sufficient means have not been at hand to carry on the operations satisfactorily.

SOIL.

The soil at this station is well adapted to the production of sugar, being of a black, volcanic nature, resembling in many respects that of the Middle Western States. The soil is very deep, filled with bowlders, cobble stones, and large gravel. The subsoil is open and porous, rendering under drainage unnecessary.

PLATE III. SERUM LABORATORY, ALABANG.

WATER SUPPLY.

A river of considerable size bounds the farm on one side and there are several smaller streams within its limits. A dam has been constructed in the larger river and a canal built which carries the water a considerable distance from the stream where it enters a tunnel through which it passes down to the sugar mill, where it is used to produce the power required for milling the cane produced on the farm. A branch of this canal carries the water out farther on to the farm, where it becomes available for irrigation purposes. Much trouble has been experienced in attempting to use the water of this river for irrigation purposes, as the hacenderos having mills farther down the river complain that there is a lack of water for power when it is used for irrigation purposes higher up the stream.

EQUIPMENT.

Little change has been made in the equipment of this farm during the past year, the old, antiquated sugar machinery still remaining in use.

OPERATIONS.

Little has been grown at this station except sugar. A few crops have been grown in an experimental way, such as vegetables, etc., but as this is in the sugar district the main crop is sugar. This crop consisted last year of 36 hectares of rattoon cane, 13 hectares being first year rattoon and 23 hectares being second and third year rattoon. The first year rattoon produced 3,862 kilos per hectare, the second and third year rattoons produced 2,295 kilos per hectare. The total yield of sugar was 102,991 kilos. The crop was about an average one for this province. Six varieties of cane are being tested for adaptability to climatic conditions and yield. Nursery plants of maguey, sisal, and kapok are being grown for distribution.

No live stock is kept at this station except the work stock used in farm operations. Foot-and-mouth disease broke out among the work stock in April and interfered with farm operations to some extent, but all have recovered and are now working again.

LIPA EXPERIMENT STATION.

This station is located near Lipa, Batangas Province, and was started some years ago to see what could be done toward reviving the coffee industry, but owing to the ravages of insects and diseases the trees have not made much growth.

Funds have not been available to push this work beyond the preliminary stage.

DIVISION OF ANIMAL INDUSTRY.

This division includes the veterinary control work, the serum laboratory, the dairy farm at Alabang, the Trinidad stock farm at Baguio, and all general investigations in animal industry.

CONTROL WORK.

GENERAL CONDITIONS.

The general conditions of animal diseases in the provinces have been distinctly worse during the year just ended then they were for the previous fiscal year. The loss of ground was due largely to the increase in the diseases prevailing among imported cattle, and to the unavoidable delay in enacting and enforcing a satisfactory quarantine law prohibiting the importation of diseased cattle and regulating the movements of live stock in the Philippine Islands.

The people of the provinces have continued to show their increasing faith in the ability of this Bureau to control infective animal diseases, by the greater support which they have given the veterinary work during the past fiscal year. Their coöperation is absolutely essential to ultimate success, but if the number and extent of outbreaks of diseases continue to increase this will undoubtedly afford just cause for the withdrawal of a large measure of their support, which has been gradually increasing during the past two years. This fact is of considerable significance. Even though much of the work necessary to the final control of animal diseases remains yet to be undertaken, the work so far done is having a constant beneficial effect.

The ultimate object should be the complete eradication of these diseases. Immunity to them is too expensive to be given serious consideration. Remedies to prevent, control, or cure them are only palliative. The only security of real merit is the knowledge that they do not exist in the country and are not likely to be reintroduced.

One of the worst features has been the necessity for constantly moving employees from one province or island to another, while the work on which they were engaged was incomplete. This Bureau should be able to maintain its agents permanently in each province and important island, so that they will become familiar with the territory and people and thus be able to do more effective work by being constantly on the ground to give prompt attention to outbreaks when they occur. This will also result in economy, as the travel necessary under present conditions is excessive compared with the amount of work done.

QUARANTINE LAW.

In view of the persistence of animal diseases in the territory from which most of the cattle shipped to the Philippines are received, efforts have been made for more than two years to secure the passage of a satisfactory law for the control of infective diseases among imported animals. On October 12, 1907, the Philippine Commission passed Act No. 1760, which is as follows:

[No. 1760.]

An Act to prevent the introduction into the Philippine Islands of dangerous communicable animal diseases, to prevent the spread of such diseases within the Islands, and for other purposes.

By authority of the United States, be it enacted by the Philippine Commission, that:

SECTION 1. For the purposes of this Act domestic animals are hereby defined as horses, mules, asses, cattle, carabaos, hogs, sheep, goats, dogs, deer, and circus animals or those intended to be used for show purposes.

SEC. 2. For the purposes of this Act a dangerous communicable animal disease is hereby defined as glanders or farcy, surra, rinderpest, hemorrhagic septicemia, hog cholera, foot-and-mouth disease, or any other acute communicable disease which may cause a mortality of over five per centum in the period of one month.

SEC. 3. It shall be unlawful for any person, firm or corporation knowingly to ship or otherwise bring into the Philippine Islands any animal suffering from, infected with, or dead of any dangerous communicable disease, or any effects pertaining to such animal which are liable to introduce such disease into the Philippine Islands: *Provided,* That any such animal or effects may be permitted by the Director of Agriculture to enter the Islands under such conditions as to quarantine, cremation, or other disposal as he may direct, or which shall be deemed by him sufficient to prevent the spread of any such disease.

SEC. 4. It shall be unlawful for any person, firm or corporation knowingly to ship, drive, or otherwise take or transport from one island, province, municipality, township, or settlement to another any domestic animal suffering from any dangerous communicable disease or to expose such animal, either alive or dead, on any public road, street, or highway where it may come in contact with other domestic animals.

SEC. 5. Whenever the Secretary of the Interior shall declare that a dangerous communicable animal disease prevails in any island, province, municipality, township, or settlement, and that there is danger of spreading such disease by shipping, driving, or otherwise transporting or taking out of such island, province, municipality, township, or settlement any class of domestic animals, it shall be unlawful for any person, firm or corporation to ship, drive, or otherwise remove the kind of animals so specified from such locality except when accompanied by a certificate issued by authority of the Director of Agriculture stating the number and kind of animals authorized to be shipped, driven, taken, or transported, their destination, the manner in which they are authorized to be shipped, driven, taken, or transported, and their brands and distinguishing marks. Such certificate shall also state that the animals in question have been inspected by a duly authorized agent of the Director of Agriculture and found free from dangerous communicable animal diseases and shall give the date of such inspection.

SEC. 6. The Director of Agriculture is hereby authorized—

(*a*) To maintain inoculation, quarantine, and detention stations for domestic animals in such places as may be approved from time to time by the Secretary of the Interior, and to place all animals arriving from foreign and domestic ports or interior places in quarantine for such time as he may deem necessary to prevent the introduction and spread of dangerous communicable animal diseases.

(*b*) To inspect all domestic animals arriving by boat, rail, or otherwise in the cities, ports, or places where quarantine stations are maintained and in such other places as he may deem necessary for the purpose of preventing the introduction and spread of dangerous communicable animal diseases within the Philippine Islands.

(*c*) To require that animals which are suffering from dangerous communicable diseases or have been exposed thereto be placed in quarantine at such place and for such time as may be deemed by him necessary to prevent the spread of such disease.

(*d*) To require the cleaning and disinfecting of any utensil, place, corral, yard, or building deemed by him to be infected with dangerous communicable animal disease, and to prohibit the keeping of any domestic animals in such place, corral, yard, or building until it has been placed in a sanitary condition.

(*e*) To require the cleaning and disinfecting of any boat, car, vehicle, or other conveyance deemed by him to be infected with dangerous communicable animal disease, and to prohibit its further use for transporting domestic animals until it has been placed in a sanitary condition.

(*f*) To coöperate with provincial and municipal boards in the suppression of dangerous communicable animal diseases and in the establishment and maintenance of municipal slaughterhouse and milk-inspection systems, the object of which shall be to prevent the slaughter and sale of animals having diseases or injuries of such a nature as to render the meats and other food products derived from them dangerous or unwholesome for human food.

SEC. 7. Whenever the Director of Agriculture shall order any animal placed in quarantine in accordance with the provisions of this Act, the owner of such animal, or his agent, shall deliver it at the place designated for the quarantine and shall provide it with proper food, water, and attendance. Should the owner or his agent fail to comply with this requirement the Director of Agriculture may furnish supplies and attendance needed, and the reasonable cost of such supplies and attendance shall be collectible from the owner or his agent.

SEC. 8. Any person violating any of the provisions of this Act shall, upon conviction, be punished by a fine of not more than one thousand pesos, or by imprisonment for not more than six months, or by both such fine and imprisonment, in the discretion of the court, for each offense.

SEC. 9. The public good requiring the speedy enactment of this bill, the passage of the same is hereby expedited in accordance with section two of "An Act prescribing the order of procedure by the Commission in the enactment of laws," passed September twenty-sixth, nineteen hundred.

SEC. 10. This Act shall take effect on its passage.

Enacted, October 10, 1907.

Early in this year the number of shipments infected with rinderpest greatly increased. The enforcement of the law, however, was generally opposed by the cattle dealers, who claimed that it would work a hardship on buyers desiring animals either for work purposes or for slaughter.

When it became evident that, to prevent the further importation of diseased cattle into the Philippine Islands, vigorous measures would have to be adopted for the enforcement of the quarantine law, a veterinarian of this Bureau was sent to Indo-China for the purpose of investigating the possible supply of cattle from that country. This action was taken because large shipments were already arriving from Indo-China. Those cattle are of the same type as the native and Chinese cattle, are from about the same climate as the Philippines, and are generally free from disease. There are, also, in this territory an abundance of carabaos, which can be purchased at reasonable prices.

It was learned from this investigation that the French Government in Indo-China has a thorough system of veterinary inspection, and Pasteur institutes connected with the department of agriculture. The work done in the control of animal diseases covers the entire territory. These facts indicate that Indo-China is a satisfactory source of supply of cattle for the Philippines.

This veterinarian was also instructed to investigate the conditions which prevail in Hongkong and report on the possibility of lessening the amount of disease existing among cattle shipped to the Philippines from that port. The information which he gathered seemed to show that the conditions under which cattle are handled in the Hongkong live-stock depot are not such as to give any guaranty that diseases will not appear there at almost any time. Soon after he returned, a shipment of cattle from Hongkong was found to be infected with foot-and-mouth disease, but before any effective measures could be taken to prevent the further importation of the disease, it had spread over the city of Manila from the private corrals in which the owners had stored the infected cattle.

General Order No. 9, designed to prevent the further importation of diseased cattle, was issued on April 30, 1908. This order met with violent opposition from several cattle dealers in the city of Manila and its operation was temporarily suspended.

At the request of the Governor-General, the colonial veterinarian of Hongkong was sent to Manila for a conference relative to the cattle trade between that port and the Philippines. The result of this conference was a decision that since the colonial government of Hongkong has no jurisdiction over the Chinese territory from which cattle are received for export, it has no means of controlling diseases among such cattle. Because of this fact there is constant infection of the stockyards at that port and of many shipments leaving there for these Islands.

On June 5, 1908, the order excluding infected cattle was reissued in the form of General Order No. 10, and on account of the diseases prevailing in Hongkong all shipments from that port have temporarily ceased.

Importers have been bringing in a few dairy cattle from Australia, but the trade in beef bullocks from that country has not been resumed. This trade was suspended more than two years ago on account of the long time en route, losses by disease after arrival in the Philippines, popular prejudice against the heavy quarters produced by Australian bullocks, and the fact that the animals are unsuited for work purposes. As these conditions still exist, and in view of the fact that large quantities of Australian frozen meats are being imported for the Army and for sale to the general public, especially in Manila, there is probably no occasion for resuming the trade.

LIVE-STOCK DEPOTS.

The establishment of live-stock depots for the principal ports of entry in the Philippine Islands has assumed definite form during this fiscal year. Under the appropriations granted last year it was impossible to do anything of practical value in this direction except to investigate the conditions existing and work to secure adequate appropriations for this purpose.

The first effective measure adopted was the passage of Act No. 1827, appropriating ₱100,000 for the suppression of animal diseases. From this amount the current expenses of the increased veterinary force were paid to the end of the fiscal year, an allotment was made for increasing the capacity for the manufacture of serum, and a sufficient amount set aside for the construction of suitable live-stock depots for the storage and quarantine of imported animals arriving in the ports of Iloilo and Cebu.

Act No. 1855 appropriated ₱150,000 for the purchase, filling, and preparation of land in Manila, Iloilo, and Cebu on which to erect live-stock depots and quarantine stations. The bulk of this money will be required for Manila. The old Spanish experiment station, "La Granja Pequeña," will be used as a site for the Iloilo depot, and land will be secured later for the depot at Cebu.

The Public Improvements Act (No. 1837) provides the sum of ₱103,000 for boring an artesian well, constructing the necessary buildings for the storage of animals, and for a forage factory in the Manila live-stock depot.

All of these appropriations taken together give about ₱280,000 to be expended in providing permanent facilities for the control of infective animal diseases. It is planned to construct all three of these depots and have them in full operation by the end of the coming fiscal year.

The value of these live-stock depots as an aid in the control of infective animal diseases in these Islands is incalculable. The provision for their construction is one of the most important moves ever made in the attempt to free this country from the ravages of infective animal diseases.

SUBSTATIONS.

The establishment of the substations to deal with local shipments of infected cattle, as recommended in the last annual report, was found impracticable until after the establishment of live-stock depots in the ports of entry. However, at the close of the year, we have in operation eleven small substations in the vicinity of Manila at which this Bureau

maintains systems of veterinary inspection and quarantine, with a view to limiting the spread of diseases through this port of entry.

IMPORTATION AND MOVEMENT.

There has been considerable increase in the live-stock trade carried on during the past year especially in the importation of cattle. The receipts for the port of Manila were as follows:

Kind.	From foreign ports.	From inter-island ports.
Cattle	37,815	2,820
Carabaos	1,750	1,298
Horses	2,170	1,862
Hogs	38	54,237
Sheep	8	186
Goats	10	841
Other animals	29	368
Total	41,820	61,612

The bulk of these animals were disposed of as follows:

Kind.	Slaughtered.	Shipped to provinces.
Cattle	26,090	10,949
Carabaos		1,711
Horses		407
Hogs	58,119	230
Sheep	10	26
Goats	368	26
Other animals	3	23
Total	84,590	13,372

The difference between these two tables is accounted for largely by sales made in the city of Manila for draft purposes, deaths in the corrals, and animals on hand at the end of the fiscal year.

Of the imported cattle arriving in Manila, 20,786 head were from Hongkong; 376 from Hai How; and 16,600 from ports of Indo-China. There were also received from Indo-China 1,750 head of carabaos. Of these, 12,978 head arrived at this port suffering from or exposed to infective diseases. All except three shipments of the infected and exposed cattle came from Hongkong, and were infected principally with rinderpest and foot-and-mouth disease, and two shipments with anthrax. Of these three infected shipments one was from the Island of Hainan, China, one from Vinh, and one from Pnom Penh, Indo-China. Of the cattle and carabaos arriving in Manila in a healthy condition, 4,262 head contracted infective diseases while being held in the corrals of cattle dealers in this city.

The receipts and shipments of live stock at the port of Iloilo were as follows:

Kind.	Number received.	Number shipped to provinces.
Cattle	2,185	903
Carabaos	590	846
Horses	436	110
Hogs	3,003	34
Goats	408	39
Sheep	526	27
Other animals	57	30
Total	7,205	1,989

The system of inspection for the port of Cebu was not permanently established until February 1, 1908, hence the statistics for that port are not complete. It appears, however, that the imports were comparatively small.

DISEASES.

RINDERPEST.

As in previous years, rinderpest has continued to be the most destructive infective animal disease existing in the Islands. The situation has been greatly aggravated by the constant importation of infected shipments of cattle from Hongkong.

On account of the increase in the number of outbreaks over the previous year, it has been necessary to limit the inoculations almost entirely to herds actually infected.

During the year, 6,933 cattle and 14,072 carabaos, or a total of 21,005, were inoculated with anti-rinderpest serum. Of these, only 621, or 2.95 per cent, are reported as having died.

The percentage of animals suffering from the disease at the time of inoculation has been very large and the total number inoculated was nearly 5,000 head more than for the previous year.

The total amount of serum used in making these inoculations was 5,384 bottles of 300 cubic centimeters each.

The principal outbreaks of rinderpest have occured in the Provinces of Batangas, Pampanga, Capiz, Antique, Occidental Negros, and La Laguna. It has also appeared to a less extent in most of the other provinces.

In many cases the provincial and municipal officials have coöperated by establishing and policing systems of quarantine, and have otherwise given valuable aid in the work. This is necessary as the Bureau of Agriculture has no means for employing a force sufficiently large to do this work throughout the Islands. Besides, to do so would be a violation of the spirit of the local self-government system in general operation throughout the provinces.

FOOT-AND-MOUTH DISEASE.

This disease has not been observed to any extent in the Philippines for more than two years. The few cases seen in Manila from time to time were no doubt due to direct importations from Chinese territory. It was reintroduced in shipments arriving in Manila from Hongkong during March, 1908. Every shipment of cattle received from Hongkong from that date to the end of the fiscal year was infected with this disease. Foot-and-mouth disease reached Iloilo and Cebu in other shipments about the same time. It has spread to more than twenty-five provinces and important islands and has attacked thousands of cattle and carabaos. It has not been, in most cases, of a virulent type but has temporarily lamed the animals so as to unfit them for work. There have been comparatively few deaths from this disease, although many of the animals which were worked while their feet were sore have suffered very severe lacerations, many of them being rendered permanently lame.

The disease still prevails to some extent in a large part of the territory between Lingayen Gulf and the southern extremity of the Island of Luzon. It has also spread to many portions of Panay and Occidental Negros. Its ravages have been most severely felt in the corrals of live-stock dealers in the city of Manila and in the surrounding provinces. More than 4,000 head of healthy cattle and carabaos which arrived in Manila free from this disease have contracted it in this city.

There is no effectual way to prevent the spread of this disease except by a rigid quarantine.

SURRA.

During the year animals were examined for surra, as shown in the following table:

Kind of animal.	Examined.	Positive.
Horses	4,311	286
Cattle	353	
Carabaos	315	22
Total	4,979	308

The number of animals found affected with the disease is nearly four times the number for the previous year. This does not necessarily indicate an increase in the amount of the disease, but rather shows that the disease is more often reported and diagnosis made by this Bureau.

The principal outbreaks of surra have occurred in the Provinces of Bohol, Cagayan, Tayabas (Island of Marinduque), La Laguna, Albay, and Leyte, with smaller outbreaks in other provinces and islands. This wide distribution demonstrates the necessity for thorough work throughout the Archipelago if this disease is to be completely eradicated.

EPIZOÖTIC LYMPHANGITIS.

This disease seems to affect horses throughout the Islands, but is not extensive or serious at the present time. Out of 2,188 animals examined during the year only 125 were found to be affected with the disease. An experiment was conducted at the Trinidad stock farm, Baguio, in the use of iodide of potassium in the treatment of this disease. The animals affected were three native pony mares, purchased a few months previously, and which subsequently developed the disease. One of them had it in a generalized form while the other two had only local lesions. The two latter responded promptly to the treatment, which seems to have effected a complete cure. The other was greatly improved but not cured.

ANTHRAX.

A disease resembling anthrax has prevailed for a number of years in limited sections of the mountain provinces, especially Nueva Vizcaya and Lepanto-Bontoc. An extensive outbreak of the same disease appeared in Lepanto-Bontoc in the latter part of July, 1907. A veterinarian was sent there, but he failed to see any considerable number of affected animals. Based on the post-mortems of two cattle he pronounced the disease anthrax, but subsequent evidence seemed to throw some doubt on this diagnosis.

This Bureau requested the Bureau of Science to begin the manufacture of anthrax vaccine, but before this vaccine could be gotten to the place where the outbreak occured the disease had largely disappeared. The territory in which this disease has prevailed is very difficult to reach and a large amount of damage may occur at any time unless a veterinarian is on the ground to give prompt attention to possible outbreaks.

On October 29, 1907, the steamer *Loongsang* arrived at the port of Manila from Hongkong with a cargo of cattle infected with anthrax. Landing permit for this shipment was denied, and it was returned to Hongkong. On the same date the steamer *Rubi* arrived in this port from Hongkong with a cargo of cattle reported to be infected with anthrax. As none of the cattle in this latter shipment were affected with the disease at the time of inspection, permit was given for their slaughter on board ship, and the meat was brought ashore and placed in cold storage.

GLANDERS.

This disease seems to be decreasing from year to year. Out of 590 horses examined for glanders this year only 61 were found to be positive. This, however, represents only a small fraction of the cases which actually existed, as the disease does not usually present alarming symptoms and often is not reported to the veterinarians.

PLATE V. QUARANTINE SHED, ALABANG.

HOG CHOLERA.

It appears that this disease has decreased its ravages to a considerable extent, although it still prevails in a number of provinces. It most often occurs among animals in the channels of trade, or where they are in crowded quarters. The examinations made by the representatives of this Bureau included 354 head of hogs, of which 94 were found to be affected with the disease.

MINOR DISEASES.

Some observations have been made in minor diseases, such as chicken cholera, mange of horses and dogs, etc., but no definite statistics or reports have been received which would be suitable for publication.

SERUM LABORATORY.

LOCATION AND BUILDINGS.

As stated in the last annual report, the old corral at the San Lazaro hospital in the city of Manila, now used for the serum laboratory, is entirely unfit for such purposes. During the year the buildings, sheds, and walks have gone into considerable decay on account of their temporary nature and for lack of substantial repairs, which it was not thought advisable to make, in view of the contemplated move, in the near future, to the new quarters at the Alabang stock farm.

More than half of the fiscal year had passed before contract was let for the buildings on this farm. On account of the small appropriation available for this purpose great difficulty was experienced in securing a contractor. The Bureau of Agriculture finally took over all of the work except the reënforced concrete laboratory building, and has made every effort to push the work to completion. Serious and apparently unavoidable delays in securing materials and laborers were encountered. For these and other reasons the work was not half completed at the close of the fiscal year. In view of the early advent of the rainy season it will not be possible to complete the buildings and get the grounds in proper condition for the removal of the serum herd there before the end of the first quarter of the coming fiscal year.

SERUM HERD.

On account of our inability to move into the new quarters, where it was expected to double the serum herd, the number of animals used for serum production during the past year has not exceeded 120 head at any time. This resulted in a constant shortage of serum, which was severely felt on account of the great demand for serum in dealing with the large number of outbreaks of rinderpest encountered in the provinces.

The serum cattle have been in excellent condition during most of the

year except for a general outbreak of foot-and-mouth disease among them about the first part of April. Practically all of the animals contracted this disease and a few of them suffered severely. Most of them recovered promptly after a few days' treatment, and the decrease in the amount of serum produced was felt only during the months of April and May.

Some difficulty has been experienced in introducing new bullocks into the herd on account of the great prevalence of rinderpest among shipments received in Manila from Hongkong, where most of our serum bullocks are obtained. This was greatly aggravated by the appearance of foot-and-mouth disease, which causes many deaths when it occurs as a complication with rinderpest. This resulted in raising the death rate among the bullocks immunized to more than 10 per cent, which is double the death rate which would normally prevail. The most serious effect, however, of this combination of diseases, was in connection with the vaccine calves where the death rate reached 25 per cent.

PRODUCTION OF SERUM.

The amount of serum produced during the year was 1,800.9 liters, or sufficient to make about 5,400 bottles of 300 cubic centimeters each. The process of centrifugating and filtering the serum, introduced January 1, 1907, has been continued throughout the fiscal year. This system results in a sterile serum which is vastly superior to the unfiltered product.

Two additional improvements of considerable consequence in the production of serum have been made during the past year. From four to eight liters of normal salt solution were injected into the peritoneal cavity of virulent blood animals two hours before bleeding them. After the animals had been bled to death this saline solution was recovered and seems to possess all the virulent properties of the blood itself. This has the effect of more than doubling the amount of virulent fluid obtained from each animal, and consequently saves half of the expense formerly incurred in providing virulent blood.[1] This process was practiced on 67 head of cattle, from which 338.5 liters of virulent peritoneal fluid were obtained, or an average of 5.58 liters per animal.

The serum made from bullocks injected with this material has been thoroughly tested by the Bureau of Science and is reported to have more immunizing power than the serum made from bullocks injected with virulent blood.

In view of these facts all cattle used for the production of virulent

[1] For a detailed account of this method see the article "*Etudes Sur la Peste Bovine*" by MM. Nicolle and Adil-bey, in "Annales de l'Institut Pasteur," Vol. 15 (1901), pp. 715–733; also see references in the "Philippine Agricultural Review," vol. 1, No. 5, p. 204, and in the Annual Report of the Secretary of the Interior to the Philippine Commission, June 30, 1908, pp. 46 and 68.

material hereafter will be injected with the saline solution for use as above indicated.

The other notable improvement in the production of serum was in shortening the time between the immunization of bullocks and the beginning of their use for the production of serum. Under the old process they were given successively 1, 5, 10, 25, 50, 100, 250, 500, and 1,000 cubic centimeters of virulent blood at intervals of from three to ten days. By this process not less than eighty days were usually required to bring the bullock up to where it would begin to produce serum. The new process consists of injecting successively 1, 10, 100, and 1,000 cubic centimeters of virulent blood or fluid, at the same intervals, the whole process covering a period of only forty days, at the end of which time the bullock begins to produce serum. The serum produced by this method was found to have as much or more immunizing power than that produced by the old method. It has given excellent satisfaction in the provincial work conducted extensively throughout the Islands.

VACCINE CALVES.

The Bureau of Agriculture has continued to furnish calves to the Bureau of Science for use in the manufacture of smallpox vaccine for the Bureau of Health. Many obstacles were met with during the year in securing a satisfactory supply of calves. With increased prevalence of rinderpest, which is particularly destructive among calves, their shipment to Manila was gradually suspended. Dealers would bring them in only on special order and then a whole shipment was often found infected with the disease. It was found practically impossible to save those in the advanced stages of the disease and, as above stated, the death rate has been correspondingly high.

One cattle dealer who desired to import heifer calves with which to stock a farm, proposed to furnish them to the Bureau of Agriculture to be used as vaccine calves with the understanding that all expenses of immunization and keep would be defrayed by the Government and that he would stand all losses resulting from death. Under this arrangement he furnished 52 calves of which 35 were infected when received. Thirteen of these died, ten from rinderpest, and three from combination of rinderpest and foot-and-mouth disease.

IMMUNIZATION.

Only 82 head of cattle were accepted for immunization during the year, of which 30 were grade Spanish cows with calves at foot or pregnant. These were purchased by the Bureau of Agriculture for an experiment in the inoculation of this class of cattle and with a view to their subsequent use as breeding stock. Of these one died from injury in shipment, eleven aborted when the symptoms of rinderpest appeared, and seven of these died.

An Australian cow from Sydney with calf at side, dropped in Manila, were submitted for immunization. As both were not immune to tick fever the symptoms of this disease developed just as they were recovering from rinderpest and both of them died.

Of the animals received for immunization sixteen were carabaos one of which died. The loss among animals submitted for immunization was 12½ per cent. This is much higher than the loss which would ordinarily be sustained, on account of the large number of infected animals which were submitted rather for serum treatment than immunization, and the large number of these cases complicated with foot-and-mouth disease.

TRINIDAD STOCK FARM.

This farm was in charge of Mr. A. S. Ashe until January 7, 1908, at which time he resigned and Dr. C. M. Morgan, a veterinarian of this Bureau was placed there.

LOCATION.

This farm is located in the Little Trinidad Valley, 6 kilometers north of Baguio. Being at a high elevation the climate is well suited to the American horses kept for breeding purposes.

WATER SUPPLY.

The water for the stock is secured from a small spring near the barns, but during very dry seasons it does not furnish enough water for the stock. If the number of stock kept there is to be increased some means will have to be devised to secure a water supply from a small river which is back of a ridge from the house.

OPERATIONS.

Considerable attention has been given during the year to the establishment of permanent pasture grasses in lieu of the native grasses which die so readily during the dry season. A number have been planted, including Guinea grass, *Paspalum dilatatum,* red clover, Dutch clover, oats, and Bermuda grass. The latter has given by far the best results as a pasture, while oats in the warmer season promise heavy yields of green forage.

The work on this farm has continued along the same lines mentioned in the last annual report. The lines of breeding include American and native horses, native cattle with imported bulls, Shropshire sheep, and Angora goats.

About 100 acres of unoccupied public domain in the Trinidad Valley adjacent to the Trinidad farm were fenced in to be used as a breeding pasture for outside stock. The plan has been to put pregnant mares

PLATE VI. SUPERINTENDENT'S HOUSE, ALABANG.

and cows in this pasture and as soon as they have foaled or calved they were bred to the American sires kept at the farm by this Bureau. It is this system which is largely responsible for the increased amount of breeding during the year.

LIVE STOCK.

One of the notable features has been the increased interest taken by the natives, especially the Igorots, in breeding their pony mares to the imported stallions kept at this farm. The number of mares bred increased from about ten per month in October to more than seventy per month in March, which numbers include return services.

In this connection the superintendent of the farm has castrated about 100 native stallions. If continued a few years this will permanently establish the custom of castrating the native ponies instead of working them as stallions.

The live stock on hand at the end of the year consisted of 4 imported stallions, 11 imported mares, 27 native mares, 17 colts (American half-breeds and native) over one year old, 15 sucklings, 16 mature burros, 6 burro colts, 1 American jack, 2 imported bulls, 2 grade bulls, 34 native cows, 11 steers, 11 heifers, 9 work bullocks, 21 calves, 4 Angora goats, and 10 Shropshire sheep.

All of this stock has kept in good condition and the losses by accident, such as falling over cliffs, has decreased as compared with former years.

During the year two American thoroughbred colts have reached maturity and have been broken to harness. While they are not of ideal type, they are the first production of the farm, and show the possibility of raising horses in this vicinity. A number of colts of pure American blood, half-breeds sired by Morgan or Arabian stallions out of native mares and a few full native colts are coming to maturity and will be broken to harness during the coming fiscal year. They appear promising and it is to be hoped that some of them will prove valuable breeding stock for the future work of this Bureau.

The burros which did very badly for the past two years seem to be doing much better now. The large jack from Missouri is being used on some of them in the hope of breeding smaller-sized jacks suitable for mule breeding with the native mares in these Islands.

The native cows bred to Calloway and Devon bulls have produced a good crop of calves of which we now have three generations at this farm. A few of the older heifers have reached breeding age, are strikingly like their sires and are being bred to imported bulls. As soon as this class of cattle increases sufficiently the original native cows will be sold.

The Angora goats imported from Australia have continued to do well. They have been provided with shelter and have not shown the bad effects of the rainy season like native goats. It is intended to purchase a

supply of native females and add to the flock during the coming year, with the view to breeding a large number of grades for distribution in the provinces.

The sheep imported from Australia have not thrived quite so well as the goats, but have done much better than the native sheep, probably due largely to the shelter and attention given them. They have suffered from time to time with ulcers on their heads, flanks, and other exposed portions of the skin, probably due to the irritating effect of biting insects.

ALABANG STOCK FARM.

This farm has been in charge of Mr. H. N. Knight since it was opened on December 30, 1906.

LOCATION.

This farm is located at Alabang on the Batangas line of the railroad, 22 kilometers from Manila. Three trains each day make it of easy access from Manila.

SOIL.

The soil at Alabang is composed of a stiff clay which is rather difficult to work. It is underlaid with a soft shaley rock.

WATER SUPPLY.

Water for live stock was obtained during the past year by pumping from a small stream which runs through the farm near the buildings. During the dry season this water becomes very foul and it is thought that this bad water was the cause of the death of some of the calves during the dry season.

An 8-inch artesian well is being drilled which will furnish sufficient pure water for all purposes in the future.

OPERATIONS.

As this farm was intended primarily as a site for the serum laboratory every effort was made to have the required buildings constructed with the least possible delay in view of the failure to secure their erection the previous year.

As previously stated, this work has been very greatly delayed and at the close of the year it appears evident that more than three months longer will be required before the serum herd can be moved into the new quarters.

A large part of the work done on the farm during the year has been in the transportation of building materials, the quarrying of stone, the building of roads and fences, and the erection of buildings for which

this Bureau accepted contract from the Bureau of Public Works. But little attention has been devoted to bringing the land into cultivation with a view of production of forage crops, or to conducting regular field experiments, on account of the pressing demands in other directions.

Most of the land is covered with a dense growth of cogon and talahib grasses, beside other rank weeds and has not been in cultivation for more than ten years. The small plats, which had been cultivated in rice up to the time this Bureau acquired the property, had been puddled according to the native method; consequently, the clearing and breaking of the land with a view to planting crops has proved a very difficult task.

It was intended to use a steam plow on this work, but some necessary repair parts were not received until near the beginning of the rainy season. A petroleum plowing engine was secured about the same time and a small amount of work was done with it. This has resulted in a comparatively small area being planted during this year. A piece consisting of about 2½ hectares was plowed in January and allowed to lie through the dry season. In June it was thoroughly disked and harrowed into good condition. It was then thrown up in beds 1 meter wide with a liberal application of complete fertilizer and planted with white velvet beans. As soon as these have reached maturity they will be rolled and turned under with a disk plow with a view to restoring the wasted organic matter in the soil.

Among the other forage crops successfully grown have been teosinte, sorghum, and broom corn. The very foul condition of the land and the fact that it has been greatly impoverished in places by the native method of cultivating rice, have been serious obstacles in the way of securing adequate crops. Both the mechanical and chemical conditions of the soil must be greatly improved before satisfactory results can be expected.

An experiment was made in the planting of nursery-grown trees in the fence line around the border of this farm with a view to ultimately using them as growing fence posts. Among the trees planted were kapok, Australian beef wood, eucalyptus, and rain tree (*Pithecolobium saman*). As the land where most of these trees were planted was very foul, and the plantings made mostly in the heaviest part of the rainy season with an unusually severe dry spell immediately following, a large number of the trees died, but those which survived these conditions seem to be doing quite well. During the latter part of the rainy season kapok trees will be set out on all the fence lines. It will demand considerable labor for several years to protect them from fire, but if they can be saved they will furnish us with permanent fence posts.

LIVE STOCK.

The live stock on the farm at the close of the fiscal year was as follows: 1 imported stallion, 10 imported mares, 2 native stallions, 14 native mares, 11 colts, 1 jack, 1 mule, 22 imported cows, 7 grade cows, 16 native cows, 32 calves, 2 imported bulls, 19 work bullocks, 7 Chinese heifers, 1 imported boar, 5 imported sows, 8 pure-bred pigs, 21 native hogs, 5 imported male goats, 24 imported female goats, 20 native goats.

HORSES.

It was not intended to begin horse-breeding work at this farm before it was fully equipped with buildings, water supply, paddocks, and pastures. However, a surplus of stock began to accumulate in Manila and at the Trinidad stock farm, which was sent to Alabang because of the available pasturage, and the tendency has been to constantly increase the number of horses there without particular reference to their selection for breeding purposes. In fact, some of the stock at this farm is in bad condition and will have to be condemned. The colts born there are thriving well, although the mothers get a large part of their feed in the pasture.

There is now a pressing demand for an outlet of surplus American horses from the Trinidad farm and arrangements have been perfected for the transfer of 52 head of mares and colts to this Bureau from the Army. In view of the uncompleted condition of the building equipment at this farm we are totally unprepared to care for all of this stock up to the close of this year.

CATTLE.

The dairy herd has been the most important line of work maintained at this farm during the year. The cattle have kept in good condition while being pastured on the native pasture grasses. During a part of the dry season it has been found necessary to supplement this grass with some concentrated feed. More calves have been raised this year than last. This probably is due to better pasture conditions as well as to care. They have been given a liberal supply of milk which has made the amount furnished the Civil Hospital less than it otherwise would have been. During the dry season an epidemic of scours broke out among the calves which was attributed to the bad water from the creek. They have now recovered, however, and are looking well.

The total amount of milk furnished to the Civil Hospital from the dairy farm was 2,709 gallons.

A large number of native cattle on hand at this farm consists of Chinese calves which had been used by the Bureau of Science in the production of vaccine and were sent to this farm instead of being sold. This class of stock shows a great adaptability to conditions which prevail there and keep in excellent condition on the native grasses.

PLATE VII. SMALL-ANIMAL HOUSE, ALABANG.

GOATS.

The imported goats are thriving very well, living almost entirely upon the grasses found in the low lands. Seven half-breed young males have been sent out during the year to be used in crossing on native goats. Good results are being obtained by crossing our Maltese males on the native goats.

HOGS.

One of the most satisfactory branches of live-stock breeding at this farm is that of Berkshire hogs. They thrive well and breed regularly. Thirty young pigs have been sent away and eight are being raised to replenish our own breeding stock.

Boars have been loaned to parties in Biñan, Santa Rosa and Calamba.

Some experiments have been started in pig feeding, to investigate the cost of growth, maintenance and fattening with various native feeds.

Twenty pigs weighing from 18 to 30 pounds were obtained in the vicinity and tiqui-tiqui, corn, and copra meal are being used in feeding. The experiment is still running and it is impossible to give a report at this time. As the native hog is much slower in coming to maturity and putting on flesh, investigation of this kind will take considerable time.

Some feeding was done to determine the effect on the quality of the lard, obtained by feeding copra meal Two pigs are being fattened on ground corn and three on copra meal. The copra-fed hogs are fattening much more slowly than those receiving corn.

It has been observed that young pigs will eat clear copra meal almost as soon as it is offered them, but older ones have to be nearly starved before they will start eating it.

A full report of these feeding tests will be reported when the feeding is completed.

Owing to the fact that the present hog quarters are so muddy and unsatisfactory during the wet season it will be necessary to build as soon as possible a house of sufficient size to accommodate at least twelve brood sows, with pigs and two mature boars.

SMALL ANIMALS.

During the month of May, the Guinea pig and rabbit breeding work formerly carried on by the Bureau of Science and transferred to this Bureau January 1, 1908, was removed to this farm. A light material house of suitable size had been constructed and these small animals appear to be doing much better there than they were at the former location at the San Lazaro Hospital. The quarters are located on a high rocky hill where it is dry and the buildings get the benefit of the breezes from every direction.

The green forage required for feeding these animals is now produced on the farm instead of being purchased from contractors, as was formerly done in Manila.

POULTRY.

No plans have yet been perfected for starting poultry work, but this will probably be undertaken during the coming year.

GENERAL STOCK-BREEDING WORK.

It is now almost five years since this Bureau commenced furnishing stallions, bulls, boars, and other animals for breeding purposes in the provinces, by loan, sale, or otherwise. It has been constantly observed that the average person in the provinces takes little interest in the improvement of his live stock. There is no well-defined line of breeding, and the only premium of material value for improvement in this direction has been the high prices paid for racing ponies. Even this has failed to impress most of the populace with the necessity for carefully selecting sire and dam with a view to producing a speedy pony. The race horses that are winning on the tracks in the Philippines are for the most part pure accidents, as most of them have been bred on the range and their sires are unknown.

It is customary now when a consignment of ponies reaches Manila for the owner to try each of them or have them tried by some track man, with a view to finding out if there are any among them that are promising for the track. However, a definite point of value, especially with reference to horses, has been presented during the past year. A three-year old colt out of a native mare 51 inches high, and sired by an Arabian stallion formerly owned by the Bureau of Agriculture, was brought to Manila and sold for ₱1,600. He showed at a glance to be far superior to even the best average racing pony and his present value is probably many times the price paid by the purchaser. Soon after this colt was sold, another one out of a native mare and sired by a Morgan stallion changed hands at something over ₱1,000. Both of these colts were bred in Batangas Province and demonstrated to the owners of mares that as a business proposition it would prove profitable to breed to improved stallions. There was a corresponding demand for stallions in the Province of Batangas, and as such demand did not exist elsewhere a representative of this Bureau with the necessary help was sent to Batangas Province with three stallions and instructed to make a regular campaign through the principal horse-breeding sections there.

As a result, one of the stallions has had 79 services, one 64, and one 60, making a total of 203. This is more than all of the services formerly rendered by all of the stallions sent to that province by this Bureau during the past four years, and was accomplished in a period of less than eight months. Should a reasonably large per cent of the mares drop and raise foals it will mean a great boon to the horse industry of

Batangas Province. It will also greatly stimulate horse-breeding throughout the Islands, as Batangas is looked upon generally as the leading horse-breeding province of the Archipelago.

The next largest service list was 52 by the stallion Montgomery Chief, used for breeding draft mares at the city stables in Manila. The total number of services rendered by the remaining 7 stallions was 349, making a total of 604 for the 11 stallions in service.

The imported Australian bulls immunized against rinderpest have continued to do very poorly. Four additional bulls were imported from Townsville, Australia, with special instructions to secure them immune to tick fever. They were received during the month of May, and were carefully guarded against rinderpest and foot-and-mouth disease. When exposed to ticks two of them promptly died from the effects of tick fever and the other two are in rather poor condition.

Much better results have been obtained from the young half-breed Galloway bulls bred at the stock farm and sold or loaned to breeders in that vicinity.

The demand for breeding pigs continues unabated and this Bureau is quite unable to meet the demands in this direction. A number of private parties have been induced to go into the pig-breeding business and have been offering for sale a considerable number of pigs having more or less improved blood in them. These pigs sell readily at any time. This is one of the most promising lines of stock breeding which has been tested by this Bureau and gives prompt returns.

A number of full-blood and half-breed male Maltese goats have been sold or loaned to parties in the provinces for breeding purposes. Two of the full-blood goats died, but the results have been generally quite satisfactory.

However, under existing conditions of disease among animals in the Philippines, there is not satisfactory encouragement for investing money and time in this business. Breeding can not be restored to its proper position among the agricultural industries until such severe diseases as surra, rinderpest, and hog cholera are under better control, and investments in stock breeding made correspondingly secure. The importance of accomplishing this result is particularly felt in the breeding of cattle and carabaos, which are so extensively used for draft purposes all over the Islands and determine largely the amount of products sold by the farmers of this Archipelago.

Very respectfully,

G. E. NESOM,
Director of Agriculture.

The Honorable,
the SECRETARY OF THE INTERIOR,
Manila, P. I.

PLATE I. CASTILLOA RUBBER TREE, SINGALONG EXPERIMENT STATION, MANILA.

THE PHILIPPINE

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EDITORIAL.

RUBBER.

Interest in rubber planting in the Philippines is increasing steadily. Rubber is a crop which, once brought to the producing stage, increases in value from year to year. It is also a crop that does not need to be harvested when the price is low or labor scarce. There are vast areas in these Islands that are adapted to rubber growing, and the industry should receive more attention than is being given it at the present time.

The best methods for growing rubber have not yet been very definitely determined, as have those for growing many other more common farm crops. Opinions differ widely, not only as to the best kind of rubber to plant, but also as to the method of handling any particular kind of rubber after it has been planted. Hence the literature on this subject is still in a formative stage. Much that has been written in the past on the subject of rubber planting has been written for some other purpose than that of giving the facts, as for instance the exploiting of some rubber plantation that has stock for sale. Reports from men of unbiased opinions are obtainable, however, and should be carefully studied by those who intend to invest or who are in any other way interested in rubber growing.

The varieties of rubber grown for commercial purposes are, practically, three in number: (1) Para (*Hevea braziliensis*); (2) Castilloa (*Castilloa elastica*); (3) Ceara (*Manihot glaziovii*). All three varieties are grown more or less in these Islands, Para and Castilloa being particularly adapted to the southern islands where the rainfall is more evenly distributed. Ceara will thrive in the northern islands, for it grows well in higher altitudes and is better able to withstand drought than the other varieties. It has two defects, however; first, it is easily broken by high winds, and, second, it is difficult to tap. Experiments are being conducted to ascertain methods by which the difficulties encountered in tapping may be overcome, and considerable progress is being made. The Hawaiian Experiment Station has published an interesting account of some experiments conducted there along this line, and makes some very valuable suggestions which are being reproduced in this number of the REVIEW.

The main article in this issue, written by Mr. Fred T. P. Waterhouse, treats of Para and Ceara rubber. It is the purpose of the editors to publish in the REVIEW from time to time articles written by men who may be considered authorities on this subject, dealing with the phases of rubber growing in different countries, in order that the readers of the REVIEW may have an opportunity to study the methods followed in the various rubber-producing regions.

REPORT ON THE CULTIVATION OF RUBBER IN CEYLON, THE FEDERATED MALAY STATES, AND JOHORE.

By Fred T. P. Waterhouse.[1]

The cultivation of rubber trees is being extensively carried on in Ceylon, the Federated Malay States, Borneo, and Java. In these countries greater advance has been made in rubber cultivation than in any other part of the world. Virgin forests are being felled, cleared, replanted with rubber trees, and brought into bearing at a cost of from $100 to $150 (U. S. gold) per acre, while commercial rubber is produced and placed on the London market at a cost of from 24 cents to 36 cents per pound, including capital cost. The tapping of rubber trees and the method of collecting and handling the latex from the trees in a systematic and economical way is only in its infancy. As time goes on and large areas of trees come into bearing, and with the experience gained, the cost of collection should be materially reduced. The problems yet to be solved are: How old or how large the trees should be before they are ready for tapping; how to reduce the amount of bark cutting without loss; how often and for what length of time it is best to rest the trees; whether to use the single "V" method of cutting the bark, the herring-bone, or some other system. There are also the questions of whether or not it is best to cut the trees on both sides at the same time or alternately; the frequency of tapping and its effect on the quantity, richness, and strength of the rubber; the number of trees most profitable to plant to the acre, etc. I found a difference of opinion as to what tapping tools were best to use and the method of treating the latex. One question appears to be settled, however, and that is that in this part of the world the Hevea is the most satisfactory tree to plant and is being planted almost exclusively.

[1] Mr. Fred T. P. Waterhouse, as a representative of the Board of Agriculture and Forestry and the Hawaiian Rubber Growers' Association, Territory of Hawaii, made a trip to Ceylon and the Malay Peninsula for the purpose of investigating and reporting upon the status of the rubber-growing industry in those countries and methods of planting, cultivating, tapping, and treatment of rubber trees in use there. As his report would be of interest to those contemplating rubber growing in the Philippine Islands, we reproduce a portion of it, as published in the Hawaiian Forester and Agriculturist, Volume V, No. 11.

It grows well, is hardy, and will stand a great deal of abuse, while the cost of gathering the latex is less and the profit consequently greater with this variety than with any other. The annual yield of rubber per acre is greater than with other varieties. Ceara is planted to a very small extent in parts of Ceylon on the higher elevations where Hevea does not do so well. Ficus elastica was planted to quite an extent at one time but is now being abandoned or cut out. Castilloa does not do well as it grows very slowly.

HEVEA OR "PARA" RUBBER.

Hevea or "Para" rubber does best where the temperature does not go below 60°, but localities where the temperature does not go below 65° are preferred. The temperature in Malaya and Ceylon does not vary more than four degrees between the cooler and warmer months. The climate is very humid. January is the coolest month, while March is the warmest. The following table shows the weather reports for the months of April, 1907, to March, 1908, inclusive. These readings were taken at Kuala Lumpor, State of Selangor, F. M. S., which is about the center of the largest plantings in Malaya:

Month.	Mean barometrical pressure at 32° F.	Maximum in sun.	Temperature.				Hygrometer.				Prevailing direction of winds.	Total rainfall.	Greatest rainfall during 24 hours.
			Mean dry bulb.	Maximum.	Minimum.	Range.	Mean wet bulb.	Vapor tension.	Dew point.	Humidity.			
1907.													
April	29,814	145.3	81	91.1	71.6	19.5	76.5	0.832	73.7	78	Calm	12.69	2.48
May	29,883	149.2	80.8	90.5	71.8	18.7	76.5	.830	73.6	79	Calm	7.55	2.53
June	29,883	147.6	80.3	90	71.1	18.8	76.1	.819	73.2	78	SW	7.44	3.56
July	29,872	147.1	80.5	90.4	71.3	19.1	76.3	.825	73.4	79	SW	3.37	.90
August	29,884	150.8	80.9	90.3	70.6	19.7	76.2	.818	73	77	SW	.72	.72
September	29,822	147.8	80.7	90.7	70.9	19.8	76.5	.833	73.7	79	SW	6.69	1.26
October	29,874	141.3	79.4	89.5	70.7	18.8	76	.840	73.6	83	SW	12.38	2.43
November	29,881	149.8	80.3	89.3	71.1	18.2	75.8	.810	72.9	78	SW	7.73	1.50
December	29,877	137	78.9	89.3	70.2	19.1	75.8	.828	73.7	84	SW	18.92	3.65
1908.													
January	29,875	147.2	80.9	90.5	71.1	19.4	76.6	.839	73.8	79	NW	7.71	5.20
February	29,883	149.6	80.8	90.1	70.6	19.5	75.6	.807	72.9	77	Calm	14.01	3
March	29,880	143.9	80.2	89.8	70.8	19	76.8	.820	73.5	79	SW	10.10	2.67

The rainfall in the countries visited is very great and well distributed over the year. Para seems to do best in districts where the rainfall is from 70 to 150 inches per annum. An experiment with irrigated Para trees is being carried on at the present time in Ceylon in a district where there is little rainfall and in a locality where the trees are exposed to the wind which tends to wither the leaves. Irrigated trees in dry districts would in all probability do well if they were protected from the wind. There are no strong winds in the rubber districts, the wind

PLATE II. PARA RUBBER TREE, SINGALONG EXPERIMENT STATION, MANILA.

seldom exceeding a velocity of 20 miles an hour below the 3,000 feet altitude. Flat low land was originally preferred for rubber plantations but rubber does equally well in rolling or hilly country. The elevation at which most of the rubber is planted is below 200 feet. The thirty-year-old Hevea trees at Peradeniya at an elevation of 1,500 feet above the sea level, however, show an excellent growth. The soil in Malaya is alluvial and in some localities mixed with a moderate amount of sand. Sandy soil, however, is unsuitable while rocky soil is generally favorable. The following gives the analysis of some of the soil in Ceylon. I quote from Circular No. 6, Volume III, of the Royal Botanic Gardens, Ceylon, a copy of which was kindly furnished me by Dr. Willis:

CEYLON SOILS IN WHICH RUBBER IS PLANTED.

It is obvious that since Para rubber has been planted from sea level up to 2,000 feet in districts such as Galle, Baddegama, Kelani, Ambalagoda, Kalutara, Ratnapura, Polgahawela, Veyangoda, Kadugannawa, Peradeniya, Matale, Kurunegala, Badulla, and Passara, there must necessarily be considerable variation in the chemical and physical properties of the soils now under this product.

The land in rubber is, in the south of the island, mainly flat; here and there steep, rocky hillsides similar to what one sees up-country are planted in rubber, but one has to leave the south of the island and go to the Central and Uva Provinces in order to see large areas of rocky, hilly land planted with this product. In many districts the alluvial soils along the banks of rivers have been planted, in most cases below flood level, so that the conditions of the Amazon valley are to some extent imitated.

Experiments have been commenced in dry but irrigable areas. The want of rain in proper proportions and quantities may prevent the extension of rubber in the northern part of the island, where only the northeast monsoon is felt and where the annual rainfall varies from 40 to 60 inches.

The soil types in which Para rubber is being cultivated may therefore be roughly divided into the following:

1. Cabook.
2. Alluvial soils.
3. Tea and cacao soils.
4. Swamps.

The cabook soils are met with as local areas in many districts. They are usually inferior from a chemical and physical standpoint, though in many cases the growth of the rubber trees appears to be satisfactory. Such soils usually show a small percentage of organic matter, potash, phosphoric acid, and lime. A typical example shows the following composition:

Analysis of typical cabooky soil.

[Mechanical composition.]

	Per cent.
Fine soil passing 90-mesh	11.50
Fine soil passing 60-mesh	9.50
Medium soil passing 30-mesh	4.00
Coarse soil and small stones	75.00
	100.00

Alluvial soil.—For physical properties these soils are usually good, and the amount of sediment periodically deposited during floods adds considerably to the chemical richness of the soil.

They are largely composed of the lighter materials carried down in suspension by moving water. The particles are very fine, most of them passing a 60-mesh. The fineness of such soils partly depends on the speed of the moving water; the swifter the flow the coarser the particles.

The particles are arrested and precipitated all along the banks of the river during flood time. During heavy floods very large quantities of matter are often deposited along the banks, but they are often of a coarser nature due to the higher speed.

The particles which go to make up all alluvial soil may have been brought from considerable distances; they constitute the fine part of soils liable to wash within the drainage area of the river. Attempts have been made in some countries to regain this suspended soil by the process called "warping," which is only practicable in the neighborhood of tidal estuaries. This is accomplished by letting the water run over the land, and then cutting it off from the main supply by sluices; after some time by repeatedly going through this process, a soil is built up. This artificial alluvial soil is usually rich in organic matter and other plant food, but usually poor in soluble food such as potash.

An example of an alluvial soil is given below. The sample was taken from the banks of the Mahaweli-ganga at Peradeniya:

Analysis of alluvial soil, experiment station, Peradeniya.

[Mechanical composition.]

	Per cent.
Fine soil passing 90-mesh	53.90
Fine soil passing 60-mesh	43.00
Medium soil passing 30-mesh	3.00
Coarse sand and small stones	0.10
	100.00

The sample is a micaceous loamy deposit in a fine state of division with a fair power of retaining moisture. There is a fairly good supply of organic matter with a good supply of nitrogen. The acidity, as is to be expected, from such a soil is nil. The mineral plant food is good in lime, magnesia, and potash, mainly derived from the mica, but is rather poor in phosphoric acid.

Tea and cacao soils.—On many estates the tea and cacao have been interplanted with rubber, and the variation in soil composition is very great.

The following analyses show the composition of tea and cacao land now planted with rubber, the latter showing a great growth in the Paradeniya district:

Analysis of soil from typical cacao land interplanted with rubber.

[Mechanical composition.]

	Per cent.
Fine soil passing 90-mesh	48.00
Fine soil passing 60-mesh	42.00
Medium soil passing 30-mesh	8.00
Coarse sand and small stones	2.00
	100.00

PLATE III. CLEARING LAND FOR PLANTING IN RUBBER, CEYLON.

Analysis of soil from typical tea land interplanted with rubber.

[Mechanical composition.]

	Per cent.
Fine soil passing 90-mesh	34.00
Fine soil passing 60-mesh	25.00
Medium soil passing 30-mesh	10.00
Coarse sand and small stones	31.00
	100.00

Swamps.—The cultivation of rubber in such areas has during the last year shown a considerable increase. Providing the draining and liming of the soils are efficiently carried out there seems no reason why continued satisfactory growth should not be obtained on such land.

The drainage should be very thorough so as to allow a good percolation of air and water through the otherwise sour soils.

In some cases each rubber tree should have a separate drainage system, the drains being 2 or more feet wide and 3 to 4 feet deep, the material from them being heaped up near the rubber tree. In other cases each line of rubber trees may be separately drained. When the drains are sufficiently large and the soil from them is heaped around the rubber, a dry soil is ultimately obtained, in areas which have hitherto been too swampy for any cultivation except paddy. The following analysis will show the general composition of such a soil:

Analysis of swampy rubber soil from the Southern Province (black soil).

[Mechanical composition.]

	Per cent.
Fine soil passing 90-mesh	36.00
Fine soil passing 60-mesh	36.00
Medium soil passing 30-mesh	1.00
Coarse sand and small stones	4.00
	100.00

The above sample shows a chemical richness in organic matter and nitrogen which rarely obtains in low-country districts and strongly reminds one of the soils at high elevations in Ceylon. It is to be regretted that the area of such rich land in the low country is small, and the above analysis is certainly encouraging to planters who have swampy soils capable of being effectively drained and made sweet by the application of lime or by burning. To a certain extent the method to be adopted with such soils is similar to that for the peaty tracts of the Nuwara Eliya district.

In planting rubber land is usually selected that is covered with virgin forest. The forest trees are felled and allowed to lie on the ground until there is a dry spell, when they are burned off. Stumps are not removed, neither are the tree trunks that do not burn, but they are left on the ground to rot. After the burning, with the exception of the large timber and stumps, the land is perfectly clean and ready for planting.

Some of the planting is done on fields that were formerly used for tapioca and also rice cultivation. After being abandoned by the planters

of these crops the lands become overgrown with "Lalang" grass (*Imperata arundinacea*), one of the most troublesome weeds in Malaya, which grows and spreads like our Hilo grass. Lalang is an oily grass and cattle will not eat it. Fortunately it will not grow in shade and consequently is easily kept out of rubber groves where the trees shade the ground, nor does it grow in the jungle. The average cost of clearing an acre of lalang is about $24 (U. S. gold), which is more than it costs to fell and clear jungle forests.

Planting is done from seed. The seed is oval in shape and about the size of an ohia seed. The bulk of the seed crop ripens in August and September, although the trees seed more or less all through the year. As the seed quickly loses its germinating power it is planted soon after ripening.

The planting of Hevea trees is done in different ways. Unquestionably trees planted "at stake" grow much quicker than trees planted in any other way and if the seeds were plentiful at all seasons of the year there would probably be more planting "at stake." In Ceylon the method that is considered the best is to plant the seeds in woven palm-leaf baskets about 8 inches in height and 4 inches in diameter and when the plants are about a foot high, plant baskets with trees in their permanent positions.[1] This basket method comes nearest to planting at stake and there is minimum uninterruption in the growth of the young plants in setting them out. The more general method, however, in the Far East is to plant seeds in nurseries about six inches apart. Seventy-five to 90 per cent of the seeds planted germinate. The ground selected to be used as a nursery is carefully prepared. It is thoroughly dug up and weeds and roots removed and the soil pulverized by hand. The young plants are left in the nurseries for several months, until they are from 18 inches to 2 or 3 feet in height, when they are stumped, the tap roots cut, and the plants transplanted, removing as little soil from the roots as possible.

Transplanting has to be done when the weather is favorable and after the land has been cleared and burned. As dry weather is necessary for a good burning, the time for transplanting varies and depends on weather conditions. The young trees are planted in rows but the distance between the trees and between the rows varies a great deal on different plantations. There is a difference of opinion on this point, but it is generally considered to be a fact that planting closer than 200 trees per acre is a failure.

A great deal of the planting at the present time is in avenues. In Ceylon most planting now being done is in avenues 20 feet wide, the trees being 15 feet apart. They are planted so that the avenues run east and west. This gives the sun a chance to shine on the soil. In

[1] Bamboo pots may be used—Editor.

PLATE IV. YOUNG RUBBER TREE IN BAMBOO POT, SINGALONG EXPERIMENT STATION, MANILA.

Malaya most planting is now being done 12 by 24, or 148 to the acre. Some planting is being done 15 by 30, or 96 per acre. One plantation I visited was planting in equilateral triangles, the trees being 17½ feet apart, or 160 per acre, as against planting in rectangles 17½ by 17½, which would give only 140 per acre.

Most plantations weed clean. This is very expensive, and there are some plantations that weed only in rows while others weed still less. I saw on one of the best paying estates, a field of two-year-old trees growing in a lalang patch where they had only weeded the lalang around each tree. These trees were doing very well. On a great many plantations the weeds are easily cleaned out after the burning, and by keeping them down at first the expense of weeding is not great. Such land can not be compared with our land where we have hilo grass to contend with. In Ceylon the older men prefer clean weeding, but green manuring is coming in vogue rapidly.

In places where the land is low and swampy it is drained so that there will be no standing water around the trees. Where the trees are planted on the hillsides drains are dug at intervals to prevent the water from carrying away the top soil.

There is no cultivation as a rule beyond hoeing the weeds as the soil does not pack and consequently does not need to be loosened. * * *

Hevea grows in two forms, one more bushy than the other. Planters in Ceylon and Malaya prefer a tree fairly branched. There is a great deal of thumb-nail pruning to make the trees branch at the height desired. This also has a tendency to make the tree large at the base. If a tree branches at 10 or 15 feet from the ground it is about right. Planters who have "topped" their trees state that it results in two large branches forming, which is apt to split the trunk where the two branches meet if the wind is strong. The more leaf area a tree has the better and the quicker will the bark "respond." * * * The question of how close or how far apart the trees should be planted is one that has had a great deal of attention and is of vital importance.

In considering the problem of how many trees it is best to plant to the acre, it is necessary to consider conditions as they are likely to exist in the future. In planting rubber for profit, it is the percentage of profit on the capital invested which determines its value as an investment rather than the gross earnings or profit per tree or per acre, or the total output of the plantation.

If we let

A. Represent acreage planted.

X. Represent number of trees per acre.

T. Represent number of times a tree is tapped per year.

C. Represent capital invested.

n. Represent number of trees per day one man can tap.

y. Represent yield per tree per day's cutting.

p. Represent price per pound of rubber.

L. Represent day wage per laborer.

E. Represent expenses other than for labor.

Then the market value of the rubber collected from one tree at a single tapping, less the cost of collecting same in laborers' time, multiplied by the total number of tappings per year on all the trees, less general expenses other than for labor, will be the total profit for the year. Dividing this by the capital invested will give the percentage of profit on the investment, or

$$\text{Percentage of profit on capital invested} = \frac{AXT\left(py - \frac{L}{n}\right) - E.}{C}$$

In this equation the value of X varies directly as C and inversely as y. The more trees planted to the acre or the larger X is the smaller the yield y will be and also the larger the capital to be invested, C. Then again the more py exceeds $\frac{L}{n}$ the greater will be the profit. Experience must determine what effect increasing n has upon the value of p and y: hence to arrive at the number of trees per acre that it is best to plant in order to obtain a maximum percentage of profit on the capital invested we must consider:

C. Capital invested.

L. Cost of labor when trees come into bearing and also what it will be in the next ten or twenty years.

p. Market price of rubber in five, ten, and more years.

y. Yield per tree at each single tapping.

T. Number of times per year it is best to tap each tree to get the best results.

n. Number of trees per day one man will be able to tap.

Some planters think it will be more profitable to plant for a period of ten or fifteen years only while others have confidence in the future beyond that time.

If trees are planted too close together they grow tall and have small leaf area and under these conditions the bark does not grow as quickly as on trees planted wider apart. Neither does the new bark form and grow over the tapped surface as quickly as in wider planting and it is now found necessary to rest a too closely planted forest, while continuous tappings can be made on wider plantings. The trees are usually considered large enough to be tapped when they are 20 inches in circumference 3 feet from the ground, but one grove that I saw which was planted 10 by 10, or 436 to the acre, although large enough in circumference when five years old, the bark was found to be too thin to tap. On another plantation they were tapping two groves of the same age,

PLATE V: LINING, HOLING, AND PLANTING PARA RUBBER, CEYLON.

eight and one-half years, one planted 12 by 24, or 148 per acre, and the other 12 by 12, or 296 per acre. The 12 by 24 trees gave an average yield of 3 pounds per tree, while the 12 by 12 trees average a little less than $1\frac{3}{4}$ pounds and gave less on second tapping, thus acre for acre the yield was about the same. The yield of rubber from each tree for one day's tapping was almost double from the trees in the 12 by 24 planting as compared with the 12 by 12 planting, and as each coolie makes 80 tappings per day in either grove the cost of collecting a pound of rubber is nearly double in the grove more thickly planted.

I visited a grove planted eleven years ago 24 by 24, or 74 per acre. In talking with the gentleman who planted these trees he stated that if he were planting for himself he would plant at least 24 by 24 (74 per acre), and perhaps 30 by 30 (46 per acre). That he would do this with the idea of making good profit twenty years from now as well as in the earlier years. Eight hundred trees in a planting of eleven-year-old trees, 60 to the acre, averaged a yield for the year of 7 pounds, or 420 pounds of rubber per acre.

Trees in Malaya usually attain a circumference of 20 inches 3 feet from the ground in from four to five years. In Ceylon a few trees will reach this size in five to six years, and many in six to seven years, when they are tapped at the base.

Hevea is usually tapped every second or third day with rests every dry season. Some estates tap as above for 15 tappings and then rest the trees from three to five months. For instance, they will tap an area one day and another the next day. If the trees are planted wide enough apart this can be kept up indefinitely, tapping each tree from 30 to 45 times a year. Tapping is usually done in the morning before the heat of the day. Some of the larger plantations tap all day or until 2 o'clock. The flow is better in the early morning. To tap, a farrier's knife, a carpenter's gouge, or some special tapping tool is used to cut the bark. A lateral cut in the bark is made, care being taken not to cut through the cambium; it is made in such a way that the latex runs down in a groove until it reaches a tin or aluminum cup which is placed at the foot of the tree.

There are a number of ways in which the cuts are made, the simplest being a "V."

The system shown in Plate No. VII is called the herringbone system. There are a number of modifications of this system such as the half-herringbone system, in which the lateral cuts are all made to run into a vertical cut. Sometimes the slanting cuts will go halfway round the tree, one side of the tree being tapped this way until all the bark has been cut and then the other half is tapped, the lateral cuts running into the vertical cut on the opposite side of the tree. Sometimes both sides of the tree will be tapped by this system at the same time, a cup

being placed on either side of the tree under the vertical cut. Again two sides of the tree will be tapped at the same time on the half-herringbone system with the lateral cuts only extending a quarter of the way round the tree, so that the two sections on opposite sides of the tree will be tapped at the same time, while the intervening sections will not be tapped until all the bark has been cut on the first sections. The space between the cuts is measured and a light cut made just deep enough to show the tapping coolie where to tap. Each time a tree is tapped a little mark is made on it so that there is a record kept as to how many times a tree has been tapped.

In one grove, where the average yield is 3 pounds per tree, the half-herringbone system of tapping was being used on both sides of the tree, the laterals going a quarter of the way round only. Each tree was tapped every other day for 15 tappings, and then the trees were rested for three months, so that during the year 45 cuts were made on each side of the tree.

A day's work for the tapping coolie was to tap 40 trees on both sides, thus setting out 80 cups to catch the latex. The coolie's work was not completed until he had picked up the thin strips of bark which were cut in tapping, bringing them, together with 80 cups of latex, to the drying room. He then, after pouring the latex into a large container, must rinse the cups with water, saving the diluted latex thus obtained so that it will not be lost. He then washes the cups which completes his day's work. Women and children tap as well as men. The aluminum cups each hold about a half pint. A little water is put in each cup when it is set out so as to dilute the latex and prevent it from coagulating before it can be brought to the drying room. The amount of latex in each cup of course varies with the yield of the tree. Some trees filling the cups full. The bark shavings that are brought in are put through the scrap machine which consists of rollers which grind the bark into a fine powder. The larger portion of the bark is separated from the scrap rubber after it comes out of the rollers, and then the rubber, and whatever bark has not been separated, is put through a second set of rollers, on which streams of water are playing. This washes the remaining bark from the scrap and the rubber is turned back into the rollers over and over again until it is in the form of crépe rubber. It is then hung up to dry with the other rubber. The latex when it is brought in is strained and set out in pans as milk is set to cream and in three or four days the rubber coagulates in blocks about the size of half a kerosene oil tin.

On several plantations they were using kerosene oil tins cut in half so that the two opposite sides of the tin would be the bottoms of the coagulating pans. Most plantations mix a little acid with the latex before it is set out in the coagulating pans to aid coagulation. The block of coagulated rubber is sometimes rolled into sheets and sold as sheet

rubber, but oftener it is put through rollers under pressure on which streams of water are playing until it is ground into the form of crêpe rubber. On one or two plantations the crêpe or sheet rubber is compressed into blocks. The drying room or house is very often made of corrugated iron, or at least the roof is corrugated iron, and the rubber is hung up to dry. Some plantations use a vacuum dryer for drying the rubber.

As there are so many methods of tapping employed on the different plantations, it is hard to say which system will eventually be perfected. I found, however, that where the single "V" system was used the amount of rubber collected per day for each coolie tapping and collecting was almost double that of plantations where they were using other systems in which five times as much bark was cut per tree.

Coolies get about 37 rupee cents per day in Ceylon or 12 cents, United States gold. In Malaya about 30 to 35 cents, Straits currency, or 18 to 20 cents, United States gold, and they work about twenty-four days, of eight to ten hours each, per month. Most of the coolies are Tamils, Javanese coming next in number, while the native Malays are employed principally in felling and clearing forests and in digging drains by contract. In Ceylon out of 450,000 laborers employed in different industries, 400,000 come from India. The Tamil coolies do not expend very much on clothing, and a great many of them manage to save money to remit to India. They are not a muscular people, having very slender arms and legs, but they can carry a greater weight on their heads than they are capable of lifting. In tapping rubber trees, the Tamils are very good as they are very quick, and it is not hard work. The Javanese are good workers and also good at tapping. The women work in the fields as well as the men, but do not get as large wages.

The output of a rubber plantation depends on the average age of the trees tapped. As the trees grow older the output will increase, but to what extent remains to be proved by experience. The output of one plantation in 1906 of 134,285 pounds, increased in 1907 to 193,506 pounds, from 84,278 trees tapped during the year or an average of over 2 pounds per tree.

Their largest trees were eleven years old, but two-thirds of them were under six years old.

This plantation was using the half-herringbone system of tapping, the laterals going half way round the tree to the vertical cut on one side while the vertical cut on the opposite side drains the lateral cuts from the other side of the tree. On the new trees that are coming into bearing they are using the single "V." A tapping is made every other day on some of the trees and every third day on others for a period of six weeks when the trees are rested for six months. There is an average of one tapping coolie to 3 acres and a carpenter's gouge is used for a tapping tool.

CEARA RUBBER.

Most of the remarks in reference to Hevea apply also to Ceara, with some important exceptions.

Twenty-three years ago Ceara was planted as shade for tea plants, but on account of inexperience in tapping and as the Ceara trees were not satisfactory as shade they were, unfortunately, nearly all cut out. Ceara rubber trees can be planted and will grow well at higher elevations than Hevea. Most of the Ceara trees I examined were growing at an altitude of from 500 to 3,000 feet above sea level. Ceara can be planted where the temperature goes as low as 45°, but a temperature above 50° is preferred. As to rainfall, Ceara does best where there is 50 to 120 inches of rain per annum. The best Ceara I saw was in a district where the rainfall is only 60 inches per annum. The trees will grow in rainier districts, however, but tapping is not so successful as in drier districts. The rainfall at the garden is 180 inches per annum. The Ceara trees shown in the picture are eight years old and though they grow tall, the largest is only 24 inches in circumference 3 feet from the ground, while the others are much smaller.

On arriving in Ceylon, I found that there was only one estate on which there were Ceara trees being tapped to any extent and the output on this estate amounted to only 4,000 pounds of rubber per year.

The main planting on the estate was cacao, coconut and Ceara rubber trees being planted for shade. No new Ceara rubber trees are being planted, but from the young trees that spring up the best only are allowed to grow while the poorer ones are cut out. As a rule these trees are 20 inches in circumference 3 feet from the ground when they are three years old and are then old enough to be tapped profitably. The manager thinks that the yield is greater when the trees shed their leaves. The growth of these young trees varies a great deal and trees that get a start when the weather is showery in the morning and sunny in the afternoon grow quicker than those which sprout when the weather is too rainy and is cold at night. An ordinary curved pruning knife is used in tapping on this plantation. The bark is cut through the cambium to the wood, removing a piece of bark an eighth of an inch wide. "V" cuts are made one above the other a span apart, but no vertical cut is made, the latex being allowed to flow over the bark. The manager claims that they get less scrap rubber in this way. The tree is tapped until an inch of wood is exposed. The other side of the tree is tapped in the same way and then the tree left until the bark grows over. There is not the "wound response" in the Ceara that there is in the bark of the Hevea tree so that in tapping by this method an eighth of an inch of bark is removed each time the wound is reopened in order to get a good flow. With the Hevea it is only necessary to reopen the wound and the thinner the shaving the better. On account of the "wound response"

PLATE VI. SOWING SEED IN PARA RUBBER NURSERY, CEYLON.

the flow of latex increases as the tappings proceed up to a certain point. This is not the case with the Ceara which is more apt to be the other way.

When the bark rots and comes off the shot-hole borer attacks the tree, weakening it, and it is likely to blow over when there is a strong wind. Experience has shown that in the more rainy districts of Ceylon tapping has been unsuccessful, killing a great many of the trees.

The bark of the Ceara rubber tree is thinner than the Hevea and has a tendency to tear if the tapping knife is not sharp. This makes it harder to tap the Ceara when the same methods of tapping are used. It is considered more satisfactory on this plantation to tap as they do rather than use more careful methods as the young trees grow up so quickly that as soon as one tree dies there is another ready to be tapped in its place. A coolie taps the trees, sets out the cups and brings in the latex, setting it out in the pans to coagulate and rolls it into biscuits the next day. This constitutes a day's work for a coolie, if he brings in enough latex to make half a pound of dry rubber.

The rubber biscuit, after being rolled and washed, is spread on coconut leaves in the dry room and usually takes about three weeks to dry. As a coolie is paid the equivalent of 12 cents gold per day, it will be seen that the labor of collecting and making the biscuits costs 24 cents per pound. The latex on this plantation is coagulated by being mixed with water. Water coagulates Ceara latex very quickly. This fact makes it more desirable and more profitable to tap Ceara trees in dry weather as the rain coagulates the latex on the tree, making a bigger percentage of scrap. Ceara latex differs in this respect from the latex of the Hevea tree. Where water is used to delay coagulation of the latex from the Hevea tree, it has the effect of hastening coagulation with Ceara latex. This makes it more difficult to handle the Ceara latex than Hevea.

On some of the tea plantations that I visited where they have a few Ceara trees remaining they are more careful in tapping and use the herringbone method, cutting only a little way into the bark and using a pricker.

The trees are scattered and a day's work for a tapping coolie on these plantations is a third of a pound per day of dry rubber. Here the rainfall is large and more care has to be taken in tapping to preserve the tree.

I visited one plantation where they had a grove of 250 Ceara trees. This was at an elevation of 3,000 feet and where the annual rainfall was from 120 to 150 inches. This is the highest elevation at which I saw rubber growing. Twenty-three years ago on this plantation Ceara rubber was planted as shade for the tea, but later it was all cut out with the exception of a belt of 450 trees. These trees in the last few years have been tapped, but since tapping commenced 250 of them have died as a

result of tapping. It is considered unsafe at the present time to take more than 250 pounds of dry rubber per year from these 200 trees. Three coolies work on the trees from September to the end of March. The largest tree is 49 inches in circumference 3 feet from the ground, and the tapping system is a series of "V"s" draining into a vertical cut.

A weak solution of ammonia (2 to 5 per cent) is used to prevent coagulation caused by water in the collecting cups, or from coagulation by churning while being carried from the trees to the coagulating rooms.

This plantation gets 4s. and 2d. a pound for their Ceara when Islands Fine (wild) Para brings 3s. and 4d., but 10 pounds of the latter equals 8 pounds of cultivated on account of its having a smaller percentage of moisture, so that the prices are really equal. It gets a little better price than plantation Para.

At present they are tapping over renewed bark without finding it necessary to remove any outer bark. The manager here thinks that if the same methods of tapping were used and the trees tapped first when young, it would not be necessary to remove the outer bark as it would not have time to get too thick. They tap the trees every third day for seven months, except in rainy weather, cutting a shaving a sixteenth to an eighth of an inch in thickness. The cut is shallow, not reaching the cambium, but a pricker is used to augment the flow. As the trees were old the outer bark removed was quite thick.

In conclusion I beg to submit the following general facts, conclusions, and opinions concerning the rubber industry which I gathered during, and in connection with my trip, which I hope may be of value to those interested in rubber production in Hawaii:

The present rubber production of the world is approximately 70,000 tons per annum.

The greatest source of rubber is the forests of Brazil which produced 41,000 tons in 1907.

The cultivation of rubber is now going on in nearly all the tropical countries of the world, being followed most largely in Mexico, Central America, India, the Malay Peninsula, Ceylon, and Java.

It is difficult to ascertain the exact area under cultivation, which is large, but the adaptability of different localities to rubber production has yet to be determined. It is certain that a very large proportion of the areas planted are unfitted for rubber cultivation or the wrong varieties of rubber trees have been planted. There is little danger of the rubber market being overstocked for some years to come from either wild or cultivated sources.

Although a large area has been planted with rubber the production of the cultivated article has just begun, as is evidenced by the fact that the output of this product from Ceylon and Malaya for 1907 was only approximately 1,178 English tons.

The unknown quantity in Hawaii is the labor question. Tapping requires in Ceylon and Malaya a man for every 1 to 4 acres, according to the number of trees planted per acre and the convenience of the location. The price of labor will also be a vital feature. In Ceylon and Malaya the laborer receives from 12 to 30 cents gold per day, while in Hawaii we are obliged to pay 75 cents to $1 per day.

As to the relative efficiency of labor in the Far East and in Hawaii, I am of the opinion that for the work of collecting rubber, our labor is as efficient and will accomplish more, as under local conditions 20 to 25 per cent more time will constitute a day's work.

The Ceara tree will grow much quicker than the Hevea tree, but, on the other hand, Hevea will yield more abundantly and the cost of collecting the latex will be less. Comparatively little attention has been given to the methods of collecting rubber from the Ceara variety of rubber tree as there are but a few dollars invested to thousands of dollars invested in Hevea planting. Tapping experiments should be made as soon as possible on our Ceara plantings in order that more may be known before our trees come into bearing. There is still much to be learned through the experience of others in various rubber producing sections of the world, but, after all, we must very largely work out our own methods and learn for ourselves how best to meet our own problems, although the experience of others will always be of benefit.

SYSTEMS OF TAPPING CEARA RUBBER TREES.[1]

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AND

Q. Q. BRADFORD,

Assistant in Rubber Investigations.

A striking characteristic of the Ceara rubber tree is that it sheds its bark at frequent intervals. The outer bark is tough and papery. As a new growth of bark forms immediately outside of the cambium layer, the outer bark dries and sloughs off. This process is continuous.

Before beginning tapping the entire outer bark should be removed from the trunk without injuring the living inner bark. This is easily done with a curved-blade knife shaped like a pruning hook, making one vertical cut and peeling off the bark in rings.

There are four systems generally employed in tapping the Ceara and other rubber trees in rubber-producing countries. These are the half herringbone, the full herringbone, the spiral, and the vertical cut systems. The half herringbone consists of a single vertical cut with laterals about a foot apart at an oblique angle extending half around the tree. The full herringbone consists of a vertical cut with oblique laterals on both sides extending entirely around the trunk of the tree. The spiral is a single or double oblique cut extending from the bottom to the top of the tapping area without vertical channels. In the vertical system there are from one to half a dozen vertical cuts without oblique laterals.

The Ceara rubber tree differs from both the Castilloa and Hevea in the rapidity of the coagulation of the latex. For this reason it has been found that the system of vertical cuts is the best. The station has carried on a large number of experiments in the methods of tapping. It has been found that the average Ceara rubber tree stops its flow of latex by complete coagulation within from two to five minutes when the latex is permitted to flow in the wound without the use of water. By trickling water over the wound the period of flow may be extended to

[1] Extract from "The Ceara Rubber Tree in Hawaii," Bulletin No. 16 of the Hawaii Agricultural Experiment Station.

PLATE VII. FULL HERRINGBONE SYSTEM OF TAPPING PARA RUBBER; DRIP TINS ATTACHED TO TREE AT TOP OF CUTS; COLLECTING TINS ON GROUND.

several minutes, but if the water is rendered alkaline with ammonia the period is extended sometimes from thirty to forty minutes.

It has also been quite definitely determined that a system of single or double vertical cuts, from 3 to 6 inches apart, without any oblique laterals except at the base, for the purpose of concentration of all the latex at one point, gives the heaviest yield of rubber and the least waste. A vertical cut is much more easily made than either the spiral, half herringbone or full herringbone oblique cuts. Another point in favor of the vertical cut is that the wound thus formed heals with the greatest rapidity.

The first cut should be extremely shallow. The cut should be flat, with sharp sides one-eighth of an inch wide, and, if practicable, not more than one thirty-second of an inch in depth—the thinnest possible shaving. It is especially important in young trees not to cut too deeply, because the bark is very thin, and there is great danger of permanently injuring the tree by cutting through to the cambium. The second tapping should be in the same cut without widening it. The next cut and the cuts of each succeeding day, as long as the tapping period lasts, should be to simply freshen the wound at one side only of the vertical incision. In this way the tapped area will be extended gradually in one direction around the trunk and will be followed by rapid healing of the wound from the opposite margin of the cut. The number of vertical cuts will depend on the diameter of the trunk. They should be not less than 4 or 5 inches apart, because the daily tappings drain the latex from the bark for from 1 to 2 inches in every direction from the wound. Enough uninjured bark must be left between the wounds to admit of rapid recovery and not too seriously interfere with the vital processes of growth.

TIME TO TAP.

The best time to tap Ceara rubber trees is at night or during the early morning. If tapping is done during the day it should be on the shady side of the tree. The reason for this is because of the tension of sap and latex in the body of the tree. Evaporation of water from the leaves is most rapid during the daytime. The greatest activity in pumping up water from the soil is also in the day. Under the action of direct sunlight the leaves accumulate great quantities of starch and sugars. At night there is a transfer of carbohydrates in soluble form from the leaves to those parts of the tree where growth and the formation of new tissues are taking place. During the hours of darkness there is almost complete cessation of evaporation from the leaves, but the roots continue to take up water from the soil. This results in tension and explains the reason why the flow of latex is much heavier and more rapid during the night. Coagulation is also retarded by the lower temperatures at night.

The best time to tap seems to be between 12 o'clock midnight and 7

o'clock in the morning. It is believed that some adaptation of the miner's lamp to be worn on the hats of the workmen will be necessary. If the tapping operation is postponed until earliest dawn it would largely increase the number of men required, owing to the few hours during which profitable tapping can be carried on.

The best season of the year for tapping has not been determined, but the indications are that it would be during the rainy season. In Hawaii the Ceara rubber trees can be tapped at any time of the year, but this operation should not be carried on during the resting period when the tree is bare.

APPARATUS AND METHOD OF TAPPING.

As a result of many trials, it was found that a cloth or canvas water bag was of great advantage in collecting the rubber. A water bag large enough to hold about a quart of water, made with alternating narrow strips of thin porous cloth and oiled cloth or canvas, is tied around the tree 6 or 7 feet above the ground, just above the tapping area. These bags are of cheap construction and will last for many months if properly cared for. A water bag should be fastened to each tree before the tapping begins and should be left on the tree during the whole tapping season.

At the base of the tree the water and latex are collected in zinc, galvanized-iron, copper, aluminum, or enameled cups, or in wooden or earthen vessels. Iron vessels should not be used because of the corrosive action of the ammonia recommended for use in tapping. The water and latex are collected at one point at the base of the trunk by inserting a thin sheet of zinc obliquely beneath the outer bark. The channel and spout thus formed are not to be fastened into the body of the tree because of injury to the wood. This tin or zinc collar and spout should be left on the tree during the whole tapping season.

The knife should cut a shallow, flat channel with vertical margins and should be capable of delicate adjustment, because the bark of the Ceara rubber tree is very thin.

The preliminaries having been attended to, a water carrier goes through the grove, filling each of the bags with a pint of water containing ammonia at the rate of one-half ounce per gallon of water. The rubber contained in the latex of young trees coagulates more slowly than that in the latex from old trees, so that in tapping a young grove a minimum amount of ammonia will be required. The water carrier should remove all scrap rubber from the tree, so that the wound will be clean and fresh for the tapper.

Immediately following the water carrier comes the tapper, who rapidly freshens the wound or cuts a new channel, as indicated above, and passes on to the next tree. As soon as all the water has dripped out of the bags,

PLATE VIII. OPENING LATEX TUBES IN AREA OF WOUND, PARA RUBBER, CEYLON.

collectors follow the tapping gang, empty the containers into barrels or other receptacles for transportation to the coagulating house or central mill.

COAGULATION OF THE LATEX.

The first operation in coagulation is to strain the latex to remove particles of bark or earth or other large impurities.

A number of methods of coagulating latex are in use in rubber-producing countries. Among these are acetic acid, sulphuric acid, trichloracetic acid, common salt, alum, heat, evaporation, churning or agitation, and centrifugal force.

In the experiments which we have undertaken, as stated above, ammonia is added to the water which flows over the wound in the bark of the tree, made for the purpose of extracting the latex from the tree. The action of ammonia seems to retard coagulation. Latex containing moderate quantities of ammonia will remain without any appreciable coagulation for considerable periods, provided the mixture of water and latex is not violently churned, stirred, or shaken. In order to get rid of the ammonia, dilute sulphuric acid is added until the mixture shows a neutral reaction with litmus paper. The addition of sulphuric acid to a point of neutralization results in the formation of a small quantity of ammonium sulphate in the liquid. After standing about one hour, a boiling concentrated solution of ammonium sulphate is poured into the neutralized latex and the whole is gently heated or left standing. As the mixture is heated the rubber separates from the latex and water mixture and rises to the surface. The temperature of the liquid should not be permitted to go above 170° F., as the elasticity of the rubber is affected by high temperatures. The same result—that is, complete separation of the rubber from the water and latex mixture—can be obtained by allowing the latex to stand for a period of two to six hours after adding the ammonium sulphate solution, without heating, but the saving of time warrants the use of heat.

The rubber can also be coagulated by adding acetic acid without the use of heat. After adding the acid the mixture should be churned or stirred.

A very pure quality of rubber can be produced by the use of ammonium sulphate, because this salt precipitates the proteids, the proteids being compounds very liable to rapid decomposition. However, from the manufacturer's standpoint, it seems to be immaterial whether the rubber is free from proteids and other impurities.

Sulphuric acid is also a coagulant, but it should only be used in very dilute solutions.

Formalin may be used in conjunction with either ammonium sulphate, acetic acid, or sulphuric acid. When present in large excess, especially

in the presence of ammonium sulphate, it has a rapid coagulating action. While the rubber produced by its use is of very high quality, the formalin preventing decomposition of the finished product, this compound is as yet too expensive for general plantation use.

Rubber may be obtained from the water and latex mixture without the use of ammonium sulphate by churning, by adding either acetic or sulphuric acid, with or without heat, or by simply allowing the liquid to stand until putrefaction begins.

One of the advantages of the collection of latex by means of water trickled over the wounds is the possibility of producing a product entirely free from bark, earth, twigs, and other gross impurities and adulterants. Where rubber has been collected from wild trees the common method has been to simply slash the trunk and branches, permitting the latex to flow down them or fall upon leaves placed upon the ground beneath the tree. This method is a very wasteful one, and the rubber thus obtained is of uniformly low value because of the amount of dirt and other impurities. This method is not at all adapted to modern plantation conditions.

Every effort should be made to produce rubber of the purest and best quality; and it is believed that such rubber can best be produced from the Ceara tree by the use of considerably quantities of water in all of the processes connected with the collection and coagulation of the latex.

A METHOD OF GERMINATING CEARA RUBBER SEEDS.

A new and rapid method of germinating Ceara rubber seeds, perfected at La Zucualpa Botanical Station (Mexico), is described by Dr. Pehr Olsson-Seffer as follows:

Place a layer of fresh horse manure in a box, to the thickness of about 6 inches, spread the seeds on the surface and cover with about 1 inch of the same material mixed with a small quantity of sand. The soil should be slightly packed and the box covered with glass. If put in a warm place or in the sun, germination will take place very quickly. The seedlings should be planted as soon as they are an inch or two high and some manure added to the soil. After such treatment the seedlings will grow very rapidly. In planting at stakes the holes should be made as large as possible, or at least 4 feet square. The soil should be well weathered and if too sour, some lime should be added before planting.

PLATE IX. TAPPING A RUBBER TREE, CEYLON

AGRICULTURE IN BORNEO AND THE FEDERATED MALAY STATES.

By F. W. Foxworthy, Ph. D., *Bureau of Science (Botanist)*.

BORNEO.

Borneo,[1] although much more than twice the size of the Philippines, has a population only about one-fourth as great. This population is scattered and has not done very much toward the development of agriculture in the island. There is no very general system of cultivation. The people in most places are in a very backward state of civilization and do not raise enough food-stuffs for their own use. Very many of the natives raise less than enough rice for their own use and must get the rest of their food by hunting and fishing or by gathering rattan and other jungle products, which they sell to traders.

The three principal divisions of Borneo are Sarawak, containing approximately 50,000 square miles (about one and one-fourth times as large as the Island of Luzon); British North Borneo, comprising perhaps 34,000 square miles (about the same size as the Island of Mindanao); and Dutch Borneo, with an area of about 205,000 square miles. These may be considered in their order of agricultural development.

SARAWAK.

The principal crops are rice, sago, pepper, gambier, coconuts, rubber, and pineapples.

Rice.—Here as in all other parts of Borneo there is but little irrigated or lowland rice. The dry or upland varieties are very generally grown. In the planting of this upland rice a very wasteful practice is followed. The habit is to clear a piece of jungle each year. After one crop of paddy the clearing is deserted and is not used again for at least seven years. By this wasteful method, considerable areas of virgin jungle are destroyed each year. The rice is usually hulled by hand. There is only one steam rice mill in the country. This mill is in the Rajang district and belongs to the American mission. I believe that it is the only steam rice mill in Borneo. Saigon rice is imported to make up the deficiency in the supply each year.

[1] Borneo, area 289,000 square miles, population about 2,000,000; Philippines, area 119,000 square miles, population about 8,000,000.

Sago (*Metroxylon rumphii* Mart.).—Sago flour, the cleaned pith of the sago palm (*Metroxylon rumphii* Mart.) is the principal article of export. The palm grows on moist or swampy ground near the houses. This situation is desirable because wild pigs will destroy the palm if it is left unprotected in the jungle.

After planting the palm very little care is given. It is propagated principally by suckers, though it will grow from seed. The preparation of sago flour is a very simple matter, consisting only of repeated washings to remove the foreign matter. Only the crudest of the washing is done by the natives who cut the palm. The pulp is so full of impurities that it has a dirty brownish color and is taken to the factory where it is repeatedly washed until it is clean and white, and when it is dry put into sacks and shipped. All the work at the factory is done by Chinese coolies. The sago flour of Sarawak is usually of very fine quality and commands a higher price than is paid for this product from other regions. The natives of Sarawak do not ordinarily eat much sago, though it is usually the chief reliance in times of famine when there is a shortage of rice.

The domestic animals are very fond of the palm and eat it in large quantities. In places where chickens are raised for export it is customary to place a section of sago palm trunk across the top of the coop to supply the chickens with food while they are going to market.

The most common form in which the product of the sago palm is seen on the tables of the Europeans of the country is the dessert known as "three-palm pudding." Pearl sago is used as the basis for the dessert and over it is poured first the expressed milk of the coconut and then "gula malacca," the very sweet dark-colored sirup obtained from the sugar palm (*Arenga saccharifera* Lab.). This makes a most pleasing and palatable dish. Where the sirup from the sugar palm is not available a very good substitute may be made by taking the sirup from the sugar of the nipa palm.

Pepper (*Piper nigrum* L.).—Pepper gardens are a very prominent feature of the agriculture of the country. The prevailing low price of pepper within the past year has caused some hundreds of pepper gardeners to leave their holdings, but there are still many hundreds of Chinese engaged in the cultivation of pepper in Sarawak.

The marked regularity of arrangement and the clean cultivation of these gardens is a pleasing and rather novel sight in a country where such things are not the rule. The cultivation of pepper in Sarawak has been described in a very interesting manner by Mr. John Hewitt in the Agricultural Bulletin of the Straits Settlements and Federated Malay States (June, 1908). A very marked thing in the cultivation of this crop is the use of burnt earth as fertilizer. The improvement after the application of burnt earth is very quick and very marked.

To one who is unacquainted with the cultivation of pepper it is a

distinct surprise to find that the black and the white pepper of commerce are both obtained from the same vine. The black pepper is the whole berry and the white pepper is the berry with the hull removed by maceration, drying, and friction.

Gambier (*Uncaria Gambier* Roxb.).—This is a rather straggling shrub and is grown quite extensively in hillside gardens. This industry, like pepper, is suffering severely from the prevailing business depression and many gardens in Sarawak have been deserted during the past year. The cultivation of gambier is considered a degrading occupation and only the lowest class of Chinese coolies (those who have no social position to lose) are engaged in it as a rule.

When the plant is fairly well grown the side twigs on the long shoots are gathered, the young twigs and leaves for a short distance back from the end of the shoot are left in order that the plant may continue its growth without undue delay. These side shoots are gathered at occasional intervals and placed in large wooden or iron receptacles for boiling. There are repeated boilings. The remains of the leaves and twigs are taken out and the remaining liquor is boiled and stirred until it is ready to harden into cakes. It is made into small cakes about 2 or 3 inches square and about 5 or 6 inches long. These are readily deliquescent and if rubbed, will easily liquefy. The coolies very often place impurities in the cakes for the sake of increasing the bulk.

Most of the gambier is sent to India and China to be used as medicine, food, or tanning extract; but some of it is sent to England where it is mixed with the cutch obtained from mangrove bark and used in the tanning of leather. The gambier is said to impart to the leather a degree of softness not to be secured by the use of any other substance.

Para rubber.—The Borneo Company, Limited, has two rubber plantations in Sarawak. The older one of these is at Poac and comprises about 500 acres. Some of the trees are over three and one-half years of age. They are on steep and rather sandy hillsides, but they are doing fairly well with clean cultivation. At Sungei Tengah the same company has a large plantation of some 2,000 acres. This is the best conducted young plantation that I have seen. The land is just freshly cleared and the young plants are making very rapid growth. In a portion of this plantation clean weeding is being done. In other places, legumes (*Desmodium sp.* and *Clitoria cajanaefolia* Benth.) are being used as a cover crop and some cassava is being planted as a temporary crop to keep down weeds. Aside from these two there are no large plantations in Sarawak. The government has a small plantation. A number of the Malay chiefs also have small plantations, but they are given very little care.

Gutta-percha.—On the plantation of the Borneo Company, Limited, at Poac, some hundreds of young gutta-percha trees have been planted along the roadways and in the jungle and are doing very well. Some

of these trees are about four years of age. It is the only place in Borneo where I have seen gutta-percha in cultivation.

Coconuts.—There are numerous small plantations which are not well cared for. In many places the trees are badly infested with the rhinoceros beetle. Unfortunately no steps are being taken to combat it and the pest continues to grow worse. There are two crude manufacturies of coconut oil in the country, which produce a second-grade oil for local use.

Pineapples.—There is cultivated in Sarawak a very much improved Kew pineapple which has a flavor surpassing that of any other pineapple I have ever seen. These pineapples are very large—often 16 to 18 inches in length and as much as 8 inches in thickness. Unfortunately the fine texture and large quantity of juice in this fruit render it unsuitable for shipment.

The durian and the mangosteen reach probably their highest development in Borneo. The mango is but little cultivated and of poor quality.

Cattle.—At the different outstations, there are kept small herds of Indian cattle in order that the outstation officers may be supplied with fresh milk. These herds are usually cared for by Kling coolies and seem to keep in very good condition. The principal beast of burden is, of course, the carabao or kerbao, as he is called by the Malays.

In northern Sarawak there is a very small breed of carabaos, adult specimens appearing not more than two-thirds the size of the ordinary carabao of the Philippines.

BRITISH NORTH BORNEO.

The one specially noteworthy crop of British North Borneo is tobacco. Lahad Datu, on Darvel Bay, is the headquarters of the syndicate. The tobacco lands run back for 8 or 10 miles from the coast and are said to constitute the largest single tobacco plantation in the world. Cultivation is at a very advanced stage and the tobacco produced is a very high grade of wrapper, commanding a very good price in the European market. The company is English, but a number of the men have received their training on the plantations about Deli, Sumatra. The soil of the Lahad Datu plantations seems much like some that we have in the Philippines. The climate is rather moist. There is no very pronounced dry season.

There are several rubber plantations which have been running for a number of years but they do not seem to have been conspicuously successful. Plantations of rubber are still being put in. Judging from the rate of growth of the young plants, these plantations should prove successful under proper management.

Coconuts are cultivated to some extent, but there are only a few very primitive presses.

PLATE X. LATEX IN SETTING OR COAGULATING TINS; TRANSPORT PAILS USED IN COLLECTING AND TRANSPORTING LATEX ON GROUND AT BASE OF SHELVES.
CEYLON.

DUTCH BORNEO.

This is very much the largest and also the most backward portion of Borneo. What is said of rice cultivation in Sarawak will also apply here. In Sambas and Pontianak there are a good many coconuts and at the latter place there are said to be two steam mills for pressing out the oil.

At Kotei Bharu, on Pulo Laut, there are a number of pepper gardens. These gardens seem to have furnished the finest of the past year's crop. The experiment of using young cotton trees (*Ceiba pentondra* Gaertn) as supports for the pepper vines has been tried here, but seems not to have been entirely successful. Where this was tried the vines do not appear to be especially thrifty. The cultivation of para rubber in Dutch Borneo has scarcely been started. It is said that there are a few small plantations in West Borneo and small numbers of stumps have been set out at certain places on the east coast, but so far as is known the holdings are small and none of them are yet in bearing. It is probable that large areas in Dutch Borneo could be utilized for rubber and gutta-percha if men and money were available to develop the country.

At Bandjarmasin near the south coast great quantities of melons, pomelos, squashes, and chickens are raised and exported to points on the east coast, in the oil field, where there is no agricultural development.

FEDERATED MALAY STATES.

Para rubber (*Hevea braziliensis*) is the great crop of the Federated Malay States and the department of agriculture is spending a great deal of time in trying to improve its cultivation. There are very large areas in rubber in the Federated Malay States. Many of the older plantations are now in bearing. The laborers are Chinese, Javanese, Kling, or other imported coolies.

There are a number of young gutta-percha plantations in the States. These are mainly under the direction of the forestry department. Cultivation here consists in the opening up of the forest and partial clearing.

Bambong (*Ficus elastica*).—This rubber is cultivated on a few plantations but is not of so high a grade as the para rubber and is more expensive in cultivation. It is probable that its future use will be only as a cover for worn out lands, of which there are many in the tin-mining region.

Lalang.—This is the same pestilent grass which we call by the name of cogon (*Imperata spp.*) in the Philippines. Large tracts of land have been rendered useless by it. In places in the Federated Malay States it has been eradicated by spraying. Elsewhere frequent cutting to prevent fruiting has given a measure of relief. Possibly the most effective means of fighting it has been with the small vine (*Passiflora foetida L.*), which takes the ground from the lalang and is not hard to tear out after it has once occupied the land.

Coconuts.—In the Federated Malay States and Straits Settlements the authorities have had marked success in fighting the coconut beetle. Infested trees are treated and breeding places destroyed. The government employs two men as inspectors of coconuts and they see to the carrying out of the treatment and preventive measures. Owners of infested trees are required to destroy such trees or to have them treated in such manner as to remove the insects. Any persons harboring breeding places for the beetles are required to clean up their premises, destroying all refuse. Any failure to comply with the provisions of the law is punishable by fine and the work of cleaning up is done by the government at the expense of the owner of the land. The treatment of infested plantations has proved very successful. Trees which for a few years were not bearing or were in poor bearing have been treated and are now restored to a thrifty condition. It is estimated that the work of inspection and treatment of the coconuts saves the people many hundreds of dollars per year. I believe that we could very profitably do similar preventive work in the Philippines.

Bananas.—On the experiment station grounds, at Kuala Lumpur, there is a considerable tract of land planted with different varieties of bananas. I believe there are said to be more than 60 different kinds in the collection. Experiments have been undertaken to determine the value as a food product of banana flour, and the yield per acre. These experiments are in a very early stage in the Federated States, but they promise to be very valuable.

The wild banana is very plentiful in the Federated States. It has been thought that the fiber from it could be profitably extracted, but it is certainly inferior to the Manila hemp and the expense of handling it is greater.

Cassava.—In Malacca and some sections of the Federated Malay States the cultivation of cassava is in bad repute owing to the wasteful methods followed by the Chinese. Virgin soil is placed in cassava and gives crops for three years. After that the yield is poor and the land is allowed to go to lalang. This is so notoriously the case that in many places the Chinese are discouraged from taking up new land for cassava. Cassava seems to take a large amount of nourishment from the top soil. If this is replaced by artificial fertilizer, the land will remain in good condition to grow cassava for many years. This is the case in the Province of Wellesley where some land is said to have been in cassava continuously for thirty years. Cassava has been used with good results as a temporary crop for a young rubber plantation to keep out the weeds. I have also seen it used in similar fashion in a young coconut plantation. So far as I have been able to learn, the cassava raised in this section is used only for tapioca.

Rice.—Large areas are devoted to the cultivation of the irrigated or

lowland rice. In order to bring larger areas up to a high state of cultivation, the government has undertaken large irrigation projects. A single one of these, in the Krian District of Perak, has brought some 70,000 acres of rice land into a much improved state of cultivation. In this same district, the department of agriculture is undertaking a number of experiments in the effort to improve the common methods of rice cultivation. The government has here forbidden the cultivation of dry or upland rice, because of the areas of good jungle which are destroyed in the clearing for such a crop.

Protective belts.—Throughout the Federated Malay States there are being left at occasional intervals strips of jungle two miles wide, for the purpose of preventing the spread of plant diseases from one cultivated section to another. As the prevailing winds are not very well known these belts are made to take quite a number of different directions. The need of such special protective measures is marked in the Federated Malay States because of the very large areas which are being planted to the one crop of Para rubber, thus favoring the rapid extension of any plant disease which may once get started.

Fruits and vegetables.—I have made it a practice to visit the markets at each place where I have been and have been somewhat surprised to find that in none of the places visited does there seem to be so great an assortment of fruits and vegetables as is regularly to be found in the Manila markets. Our markets here contain nearly all of the fruits which are found in Borneo or Malaya and the quality is better than is found in most places.

Domestic animals.—The common draft animal is the Indian bullock. The carabao is also very common, particularly in the district where rice is the main crop. In certain portions of Perak there is a most strikingly large percentage of pink or albino carabaos.

In the State of Pahang there have been frequent and serious outbreaks of rinderpest, which have destroyed many of the carabaos and occasioned much distress.

THE AGRICULTURAL BANK OF THE PHILIPPINE GOVERNMENT.

By Frank A. Branagan,

Insular Treasurer, and Manager of the Agricultural Bank.

Before discussing the law creating the Agricultural Bank of the Philippine Government and describing the operations of the bank, a brief mention of similar institutions in other countries is deemed appropriate.

SOUTH AUSTRALIA.

In 1895 the State of South Australia provided by law for the loaning of money by the State to settlers and farmers. Capital was procured by the sale of mortgage bonds by the State, which were guaranteed by the government, and the loan operations are carried on by a State bank. Funds are loaned to farmers in aid of rural industries and to local branches of the government for the purpose of acquiring bridges, wharves, roads, and other permanent improvements and for the redemption of existing indebtedness. The loans are for any period not exceeding forty-two years, and when on the security of a freehold are for not exceeding three-fifths of the unimproved value of the land and the permanent improvements thereon, plus one-third of the value of any cultivation, the valuation not to exceed the amount of the last tax assessment of the property. On land leased from the government the bank will loan a sum not exceeding one-half of the sale value of such lease. Not over ₱50,000 can be loaned to any one person or company. Local authorities, or local branches of the government, may borrow not to exceed the cost of any works to be constructed or acquired, or the amount of the indebtedness to be redeemed. The security required from farmers is a mortgage on the land and a bill of sale of the buildings, etc., and from the local authorities a pledge of their revenue. Loans are repayable in semiannual installments of principal and interest, on April 1 and October 1. The interest must not exceed 5 per cent per annum. The borrowers pay the cost of inspection, appraisement, examination of title, registration of mortgage, etc. A general banking business is not conducted.

QUEENSLAND.

In 1901 the Parliament of Queensland created the Agricultural Bank of Queensland. The bank raised its capital by the sale of its bonds, and loans are made to owners of agricultural lands, or to persons occupying Crown lands as agricultural farms, agricultural homesteads, grazing farms, grazing homesteads, and miners' homesteads. The amount of the loan may not exceed 65 per cent of the value of the security, and not over ₱8,000 may be loaned to any one person. The interest charged is 5 per cent per annum, payable semiannually, and the principal may be repaid in installments. The borrower pays all expense of inspection, appraisement, examination of title, registration of mortgage, etc. Until the loan is fully repaid, the borrower may not subdivide or lease his land without the consent of the bank. Funds are loaned for the following purposes, viz:

(1) For the payment of liabilities already existing on the property.

(2) For conducting agricultural, dairying, grazing, horticultural, or viticultural pursuits.

(3) For adding to the improvements already on the property.

(4) For purchasing stock, machinery, and implements.

No loan may be made by the bank "to any aboriginal native of Asia, Africa, or the Pacific Islands."

When a loan is advanced in installments, interest runs from the dates the installments are advanced to the borrower.

A general banking business is not done.

NEW ZEALAND.

In New Zealand agricultural loans are made by a department or branch of the government known as "Government Advances to Settlers Office." The business of the office is the advancing of money in New Zealand on first mortgages of lands and improvements. Loans are made on the "installment system" or the "fixed-loan system," and the margins of security are as follows:

(1) On freeholds, three-fifths of the value may be loaned either on the installment or the fixed-loan system, provided that in the case of first-class agricultural freeholds installment loans may be made up to two-thirds of the value.

(2) On leaseholds, three-fifths of the value of the lessee's interest in the lease may be loaned on the installment system. No loans are made under the fixed-loan system on leaseholds.

(3) On urban or suburban freeholds, loans are made on the installment system only.

No loans of less than ₱250 nor more than ₱30,000 can be made, and in the case of urban and suburban freeholds the maximum loan is ₱20,000.

Fixed loans are for any period not exceeding ten years, and the principal is repayable at the end of the term. They may also be repaid in whole or in part on any half-yearly due date during the term. Interest is at 5 per cent, payable semiannually, reducible to 4½ per cent if payment is made not later than fourteen days after maturity. Installment loans are repayable in seventy-three half-yearly payments of principal and interest combined. They may also be reduced to 4½ per cent interest if payment is made not later that fourteen days after maturity. The borrower, in both cases, pays the cost of inspection, appraisement, examination of title, registration of mortgage, etc. No general banking business is done.

The operations of the office are described as follows: A man owning land used for farming, dairying, or gardening, makes application for a loan on a regular form and files the same with the superintendent of the office, inclosing a valuation fee. The superintendent immediately transmits the application to the valuer-general, who instructs the valuer for the district in which the land is located to make a report to the superintendent, for which service the valuer receives the fee paid by the applicant on submitting his application. The superintendent submits the application and the valuer's report to the general loaning board, which passes on the loan, allowing it in full or in part, or rejecting it entirely. The applicant is notified of the board's decision. If the loan is made, an account is opened with the borrower in the head office. The title to the security having been examined, value certified, mortgage drawn, etc., by the solicitor, a check for the amount of the loan is forwarded to him. He deposits it, and draws a check on the account, payable to the borrower or his agent, for the amount of the loan less the solicitor's charges. Interest and other payments are made to the Postal Savings Bank most convenient to the borrower, which bank forwards the amount, through proper offices of the Postal Savings Bank. The office has loaned something over ₱40,000,000.

EGYPT.

The sole business of the Agricultural Bank of Egypt is to loan money to small land owners. The loans are of two kinds, viz:

"A loans," from ₱5 to ₱200, which are repayable with interest in one sum the following crop season, but if made only two or three months before that time, they are not collected until the following year. The maximum period for these loans is fifteen months.

"B loans," from ₱100 to ₱3,000, payable in five annual installments at the crop season.

Never more than 50 per cent of the value of the land is loaned. The "A loans" have no special security beyond the crop, but the "B loans" are secured by a mortgage on the land.

Collections of principal and interest are made at the time the taxes

are collected, by the government tax collector, who is allowed one-half of 1 per cent on all collections he makes.

The following is the procedure that is adopted: Application blanks are had from the head man of each village. A landowner requiring a loan obtains one of these forms and fills up the part that concerns him. He then takes the application to the tax collector, who keeps the land register, and gets him to fill up and sign a certificate as to the ownership and incumbrances on the property. In the case of "B loans" he has also to get the village measurer to give the description and area of the land to be mortgaged. This having been done, the applicant presents his application to the bank's agent in the district, who, after consideration of the value, admits or rejects the application. If the application is admitted, the bank's agent sends it direct to the tax collector for him to fill up his second certificate. When the bank's agent receives the application back from the tax collector, he sends it to the head office of the bank in Cairo, where it is carefully checked and examined. If it is all in order, in the case of an "A loan," the bank at once issues a pay order to its agent to pay the amount to the applicant; in the case of a "B loan," a pay order is sent to the agent, but only after the mortgage on the applicant's land has been duly registered. The lists of sums to be collected by the tax collectors are prepared by the bank's agents, who likewise calculate the interest, and are sent to the head office of the bank, where they are checked. They are prepared separately for each village, and are sent to the ministry of finance, by whom they are passed on to the tax collectors with instructions to collect on the date of maturity. The interest is charged to the end of the month in which payment is due, and all money collected that month is credited to the bank by the government on the first of the following month, the government sending lists of collections made to the bank as soon after the end of the month as possible. In the case of "B loans," the registration of the mortgage is effected as follows: The agent of the bank in the district, at the same time as he sends the application to the head office of the bank in Cairo, also sends to the tribunal where the deeds have to be registered, a list of applications with description of the lands they propose to mortgage. In each tribunal the bank has a clerk, who on receipt of these lists checks them with the court registers of mortgages to see that there exists no legal charge already on the land. Although the tax collector has certified on the application that there is no such charge, this further check is necessary as the owner of the land may have mortgaged it and the tax collector not yet received the notice from the court. The bank's clerk at the tribunal after he has checked the lists, forwards a report to the head office of the bank at Cairo. If this report is favorable, the mortgages are at once prepared in the legal department of the bank, and notice sent to the applicants to appear on a certain date

at the tribunal where the mortgage is executed and registered. The cost is paid by the applicant.

A general banking business is not carried on by the bank.

OKLAHOMA.

When the Territory of Oklahoma was created the United States reserved two sections of land in every township for school lands. The Indian Territory, being composed entirely of Indian Reservations, had no school lands. When the two Territories were admitted into the Union as the State of Oklahoma, the United States donated ₱4,000,000 to Indian Territory for a school fund, so as to place her on an equal footing with Oklahoma Territory. This fund of ₱4,000,000, became, of course, the property of the State of Oklahoma, and to invest it an office was created and authorized to loan the money exclusively to farmers, on real estate security. The money loaned may be used for any kind of agricultural purposes, is repayable at any time in not exceeding ten years, draws 4 per cent interest per annum, and the borrower pays the expense of the abstract of title, fee for examination of title, expenses of inspection and appraisement of the property, and the recording fees, which expenses run from ₱30 to ₱70. About half the fund has been loaned.

THE PHILIPPINE AGRICULTURAL BANK.

The Agricultural Bank of the Philippine Government was created by Act No. 1865, of the Philippine Legislature, June 18, 1908. It is a body corporate, and has a separate and distinct entity from the Government, and possesses all the general powers of corporations. Its capital is ₱1,000,000, appropriated from the public treasury. The affairs of the bank are administered by a board of directors consisting of five members, three of whom are appointed by the Governor-General, and the Secretary of Department of Finance and the Treasurer of the Islands are ex officio members of the board. The Insular Treasurer is also ex officio the manager of the bank.

The bank is empowered to do a regular banking business, including the receipt of time deposits, at not exceeding 4 per cent, from the Postal Savings Bank, provincial and municipal governments, and others, and may establish agencies in the provinces for doing a similar business. The principal object in creating the bank, however, was to enable the farmers in the provinces to borrow money at a reasonable rate of interest, repayable at any time in not exceeding ten years.

The loans bear 10 per cent interest per annum, and the security required is a first mortgage on any of the following classes of property, viz:

(1) Unincumbered improved urban property.
(2) Unincumbered agricultural land.
(3) Gathered and stored crops.

The bank can not loan to exceed 40 per cent of the value of the property offered as security, and may not loan less than ₱50 nor more than ₱25,000 to any one borrower, and 50 per cent of the capital is set apart for loans of not over ₱5,000. Loans may be made for any of the following purposes:

(1) To redeem agricultural land from existing incumbrances.

(2) To pay the cost of constructing drainage works on agricultural land.

(3) To pay the cost of constructing irrigation ditches and dams.

(4) To purchase fertilizers.

(5) To purchase agricultural seeds.

(6) To purchase agricultural machinery.

(7) To purchase agricultural implements.

(8) To purchase carabaos and work animals to be used in agricultural work.

No money can be loaned except to persons engaged in agriculture, and it must be used exclusively for one of the above mentioned purposes. Persons applying for loans on real estate security are not required to have a certificate of title issued by the court of Land Registration (Torrens), but they must own the land in fee simple, by Torrens title, title of dominion, or otherwise.

The bank furnishes free of charge all necessary blanks for making application for loans, and any person wishing to apply for a loan may secure such blanks from the manager of the bank at Manila or from any provincial or municipal treasurer. There are no fees or commissions of any kind to be paid to any one by the person making a loan, except the cost of recording the mortgage to the bank at the time the loan is made. The interest begins to run the day the money is paid to the borrower, and runs until the money is repaid to the bank. If any partial payments are made the interest on the amount paid stops the day of such payment.

Anyone desiring to negotiate a loan procures and fills up the application blank furnished by the bank, and forwards it to the manager at Manila, where it is examined and recorded. If it is found in proper form, and otherwise correct, the manager forwards the application to the treasurer of the province where the land is located, for reference to and investigation by the provincial board. The provincial board sometimes refers the application to some one of its members or to the municipal president or treasurer in whose jurisdiction the land is situated. The manager requires a report as to the correctness of the applicant's statements concerning the land, as to the market value of the land and what it is assessed at for taxation, etc. When the application and report are received from the provincial board, the manager submits them to the board of directors of the bank, which either refuses or authorizes the loan. If a loan is authorized, a mortgage and promissory note are prepared

and sent to the applicant for execution. When they are returned by him, the mortgage and applicant's muniments of title are forwarded to the bank's legal adviser for his opinion as to the applicant's title and the sufficiency of the mortgage. If he approves, the mortgage is sent to the registrar, who records it, and notifies the manager whether the mortgage to the Bank is the first and prior incumbrance on the property. If it is, the money is paid to the applicant, or part paid to his mortgagees, or to others for him.

Collections of interest and principal of loans are made by the bank, or by any of its provincial agencies, and arrangements will probably be made with the Postal Savings Banks to make such collections in places where the bank has no agency.

The bank opened for business at Manila on October 1, 1908, and an agency at Zamboanga was opened for business on January 11, 1909.

IRRIGATION PROJECTS—REPORT BY THE IRRIGATION ENGINEER.

MANILA, P. I., *November 18, 1908.*

SIR: I have the honor to report on the status of the irrigation division and of projects received and investigated to date.

On June 25, 1908, authority was received for the following engineers:

2 assistant engineers	₱5,000
2 assistant engineers	4,500
2 assistant engineers	4,000
4 assistant engineers	3,600
4 assistant engineers	3,200
6 assistant engineers	2,800
2 Filipino engineers	1,800
2 Filipino engineers	1,600
2 Filipino engineers	1,200
2 Filipino engineers	1,000
24 surveyors	360

Of the above there are now assigned to the irrigation division the following:

2 assistant engineers	₱5,000
1 assistant engineer	4,500
1 assistant engineer	3,600
15 assistant engineers	2,800
2 Filipino engineers	720

and a varying number of surveyors.

Of the above two are on duty in the Manila office, myself and Mr. Larrison, who is acting as my assistant. There are five field parties comprising fifteen American engineers, two Filipino engineers and a number of surveymen. The other two American engineers are confined to the Civil Hospital with typhoid fever. One assistant engineer assigned to irrigation work was ill for over a month with typhoid fever and has been temporarily assigned to work on the Benguet Road to facilitate his convalescence. It is hoped that as soon as his health will permit he will be returned to irrigation work. The above force, together with one stenographer, completes the present force of the irrigation division.

Projects.—Authority has been received for either preliminary, further or final investigation of twenty-three projects. Preliminary reports have been made on fifteen projects and reports are pending on three projects

for which preliminary investigations have been completed. There are two projects in process of preliminary investigation. Final surveys have been made on one project and are in progress on three.

In addition to the above there are a number of reports from provincial boards which are under consideration and a large number of projects may be brought out from these reports.

The principal projects under consideration are as follows:

The Ambalangan-Dalim irrigation system, Province of Pangasinan; area to be irrigated, 12,000 hectares; water to be diverted from the Agno River; estimated cost, ₱500,000. A party of four engineers are now making final surveys, which should be completed by about January 1. Report can be presented to the irrigation committee by February 1 for consideration. Some construction may be begun in April, 1909, but the larger part will have to be done in the 1909–10 dry season.

The Pototan irrigation system, Province of Iloilo; area to be irrigated, 4,000 hectares; water to be diverted from the Suague River; estimated cost, ₱100,000. A party of four engineers are now making final surveys of the project. Their report should be ready for presentation to the irrigation committee by January 15, 1909. Designs would follow and work could be commenced as soon thereafter as practicable.

The Pilar irrigation system, Province of Bataan; area to be irrigated, 250 hectares; estimated cost, ₱4,500 to ₱6,000. The final investigation of this project has been finished, and the report with estimates and partial designs is in the hands of the irrigation committee. Construction may be begun as soon as certain questions regarding water rights and use of old dam can be settled. It is hoped that this work may be completed by April, 1909.

The San Miguel irrigation project, Province of Tarlac; area to be irrigated, 3,000 to 4,000 hectares; estimated cost, ₱100,000 to ₱150,000. This project is now under very complete investigation by a party of three engineers, and it is probable that final report will be ready by December 15, 1908. Designs would follow and construction could be begun at any time thereafter.

The Iba irrigation system, Province of Zambales; area to be irrigated, 400 hectares; estimated cost, ₱5,000. This project, which is the repair and reconstruction of an existing system, is under final investigation by a party of three engineers. This same party will also make preliminary investigations of eight or ten projects in the province of Zambales. Final report on the Iba project should be ready for presentation by January 1, 1909, and construction might be commenced in February or March with good prospect of completing the work by the beginning of the next rainy season.

The Dingras irigation system, Province of Ilocos Norte; area to be irrigated, 1,000 hectares; estimated cost, ₱20,000 to ₱30,000. This

project is now under final investigation by a party of three engineers. Final report should be ready for presentation by January 1, 1909, and construction may be begun as soon thereafter as funds are available.

In addition to the above there are several large projects to be investigated such as the Abra River project, and the Amburayan River project, both of which will cost upward of ₱500,000 to construct. An investigation of a project to use the waters of the Norzagaray River has been recommended to the irrigation committee.

Investigation has been authorized on a project in Pampanga and will be taken up soon.

There is also considerable preparatory work being done in seeking projects from information obtained from provincial reports and from other sources.

The projects which merit special attention are the Ambalangan-Dalim; the Pototan; the San Miguel, Tarlac; Iba, Zambales; Pilar, Bataan; and Dingras projects. It is probable that construction on any of these might be begun before July 1, 1909, and in one or two instances, namely, Iba and Pilar, might be completed before that time. The Ambalangan and Pototan projects are large and more time will be necessary for their construction. It will be necessary to proceed carefully on the larger projects on account of the lack of reliable data regarding the rivers from which water is to be taken. Structures must be designed to make the fullest possible use of the low water flow of the rivers and yet must withstand the enormous floods which are encountered here.

The attached tabulation entitled "Tabulation showing status of irrigation projects" shows the name and location of projects, the estimated area which will be served and a preliminary estimate of the cost of construction, the character of the investigations and reports, and the present status of projects.

The estimates on such projects as general investigations of Ilocos Norte, Abra River system, Amburayan River system, and Norzagaray River system are made from a general knowledge of the country obtained on inspection trips in these localities.

There is also attached an estimate of the probable expenditures or allotments before July 1, 1909, showing a probable disposition of the ₱250,000 appropriated by Act No. 1688 and the ₱500,000 appropriated by Act No. 1837 for irrigation projects.

The question of river gauging has been receiving considerable attention. One hundred gauge boards have been ordered and fifty have been received. Forty have been distributed and about twenty gauging stations are in operation. Current gaugings have been made of several rivers, but this part of the work has been delayed waiting the arrival of current meters ordered early in July of this year.

Instructions for establishing gauging stations, gauging rivers, and

for making investigations have been prepared and placed in the hands of the chiefs of parties together with sample copies of all money papers and reports necessary for the proper handling of the work. This division handles considerable correspondence regarding irrigation and other hydraulic subjects.

The greatest present need of the irrigation division is the services of one or two engineers experienced in irrigation design and construction. The present chief of the division now attends to that work, but the routine work of the division leaves little time for a studious consideration of design.

Respectfully submitted.

H. B. KIRKPATRICK,
Irrigation Engineer.

DIRECTOR OF PUBLIC WORKS, *Manila, P. I.*

Estimated expenditures of irrigation division to July 1, 1909.

Engineering expenses, November 1, 1908, to July 1, 1909:			
Salaries, 8 months, at ₱5,500			₱44,000
Subsistence and per diems, at ₱1,000			8,000
Instruments and equipment			14,000
Traveling expenses, at ₱500			4,000
Estimated for increases in force and promotions			3,000
Expenses of committee, travel, etc			5,000
Estimated for consultation on laws, etc			15,000
Total			93,000
Previously allotted	₱50,000		
River gaugings	10,000		
		₱60,000	
Exenditures to November 1, 1908	22,000		
River gaugings to July 1, 1909	10,000		
		32,000	
Balance available			28,000
Necessary to allot to carry division to July 1, 1909			65,000
Appropriations:			
Act 1688			250,000
Act 1837			500,000
			750,000
Allotments:			
Irrigation division committee expenses, etc		50,000	
River gaugings		10,000	
			60,000
Balance unallotted			690,000

Estimated expenditures of irrigation division to July 1, 1909—Continued.

Estimated cost of Ambalangan-Dalim project	₱500,000
Estimated cost of Pototan project	100,000
Estimated cost of Pilar project	6,000
Estimated cost of Iba project	5,000
Estimated expenses to July 1, balance	65,000
Total	676,000
Leaving an estimated unallotted balance on July 1, 1909, of	14,000
Status July 1, 1909:	
Appropriation for 1910	750,000
Unallotted balance for 1909	14,000
	764,000
Probable unexpended balance of allotments proposed above for 1909	500,000
To be expended by division in fiscal year 1910	1,264,000

Tabulation showing state of irrigation projects, December 1, 1908.

Name of project and location.	Area (hectares).	Estimated cost (₱).	Character of investigations and reports.	Present status.
Ambalangan-Dalim system, Pangasinan.	12,000	500,000	Preliminary and further investigations made and reported.	Under final investigation by party of 4 engineers.
Pototan irrigation system, Iloilo.	4,000	100,000	Preliminary investigation made and reported.	Do.
Pilar irrigation system, Bataan.	250	4,300 [a] 6,000	Preliminary and final investigations made and reported.	Reports now in hands of the irrigation committee.
Iba irrigation system, Zambales.	400	5,000	Preliminary investigation made and reported.	Final investigation now being made by party of 3 engineers.
Dingras irrigation system, Ilocos Norte.	1,000	20,000 [a] 401,000	----do	Under investigation by party of 3 engineers.
San Miguel irrigation system, Tarlac.	3,000 4,000	100,000 [a] 150,000	----do	Investigation completed. Report in preparation.
Sibalom-San José irrigation system, Antique.	3,000	111,000	-----do	Laid on table by irrigation committee as Province did not accept double cedula.
Dinalupijan irrigation system, Bataan.	2,000	(80,100)	Preliminary investgation made on 3 projects. Reported.	Laid on table by committee as there is no demand for irrigation in the district. Population sparse.
Orion irrigation system, Bataan.	300	5,000	Preliminary investigation made and reported.	Waiting further information as to attitude of interested parties.
Orani River project, Bataan.	200	5,000	-----do	Held up as inhabitants of district are opposed to this project.
Balsik River control, Bataan.	----------	----------	Investigated and reported.	Committee filed papers, as action did not seem to to be necessary.
Tanauan irrigation system, Batangas.	400	88,250	Preliminary investigation made and reported.	Papers are laid on table on account of high cost per hectare for installation.
Nagdasig Canal, Bulacan.	----------	[b]	Investigation made.	Report in preparation, not exactly irrigation.
Marilao Well irrigation system, Bulacan.	----------	[b]	Investigated and reported.	No action necessary on part of committee. Project is unimportant.
Canal—Calumpit to Malolos, Bulacan.	----------	[b]	Investigated by district engineer. Report not received.	Awaiting report of district engineer. Absolutely no information at hand upon which to base estimate.

[a] In this total the higher figure has been used in every case.
[b] Information not available for estimate. Usually not purely irrigation project.

Tabulation showing state of irrigation projects, December 1, 1908—Continued.

Name of project and location.	Area (hectares).	Estimated cost (₱).	Character of investigations and reports.	Present status.
Norzagaray River system.	(20,000)	(1,000,000)		Presented to irrigation committee recommending investigation. Awaiting action.
Jalaur irrigation system, Iloilo.	(3,000)	(90,000)		Investigation recommended; awaiting action.
General investigation of Province of Ilocos Norte.	(20,000)	(1,000,000)		Investigation authorized. Awaiting available men.
Abra River system, Ilocos Sur.	(30,000)	(1,500,000)		Do.
Balaoan irrigation system, La Union.	2,500	4,000	Preliminary and further investigation made.	Awaiting report of district engineer on further investigation.
Bacnotan irrigation system, La Union.	1,500	30,000	Preliminary and further investigation made.	Do.
Amburayan River system, Lepanto-Bontoc.	(15,000)	(750,000)		Authority received for investigation; awaiting available party of engineers.
Barugo irrigation system, Leyte.	(3,000)	(100,000)	Preliminary investigation by district engineer.	Awaiting report from district engineer.
San Vicente Canal, Bayombong, Nueva Vizcaya.		[a]	Investigation made and reported.	₱11,775 appropriated by Act No. 1688. Awaiting further developments in river.
Bago irrigation system, Occidental Negros.	[b] 4,000 [c] 6,200	582,900	Preliminary and further investigation reported.	Held up by irrigation committee on account of high cost for rice land and uncertainty of irrigation for sugar land.
Silay irrigation system, Occidental Negros.	5,000	50,000	Preliminary investigation made and reported.	Laid on table, as there was not enough water for the system.
Sta. Rita-Betis, Guagua Canal, Pampanga.	600	40,000	do	Further investigation authorized. Awaiting available party of engineers.
General investigation of Province of Zambales.	(3,000)	(100,000)		Under investigation by party of 3 engineers.
Total		[d] 6,257,150		

[a] Information not available for estimate. Usually not purely irrigation projects.
[b] Rice.
[c] Sugar.
[d] In this total the higher figure has been used in every case. Figures in parentheses are merely general estimates and are not based on investigations.

THE CROP-REPORTING SERVICE.

Having completed the year 1908, during which time the crop and live-stock reporting service has been much improved, it seems well to give a rough sketch of the work that has been accomplished, for the benefit of the corps of reporters who have contributed such valuable aid.

The crop-reporting service was established by the Bureau of Agriculture two years ago for the purpose of collecting and compiling statistical data pertaining to agriculture. Nearly all this time has been employed in preparatory work and overcoming the many difficulties which would necessarily arise in a country where agricultural statistics have never been worked upon systematically.

Toward the close of the year 1907 there were about 400 correspondents, who sent in an average of 374 reports, while in 1908 their number went up to 700, with an average of 517 reports, thus making an increase of 38 per cent. All of them are sending in their monthly reports on crops and live stock with fair regularity, besides an annual report in the form of a supplement or summary of the whole. A few of our correspondents send their reports only once in every two or three months, but this delay seems to result in a gain both in quantity and quality.

Considering the conditions which prevail in these Islands the results obtained in two years' experience of reporting on crops and live stock have been fairly satisfactory. Our informants are becoming more accustomed to the work and therefore more accurate in filling out our blank forms. Of course we must take into account the difficulties they have to encounter in getting information. In addition to the suspicion aroused by the questions asked the farmers and the unreliability of their answers there remains the great difficulty in estimating the extent of the lands under cultivation. In most municipalities which include insolated barrios considerable money and energy is involved in obtaining information. Correspondents of small means can not very well answer the purpose, nor can those who are at the same time public officials on duty.

Statistics are necessary to the advancement of a country. Without reliable statistics the agriculturist would not know what his country does or could produce, nor would the consumer or the exporter know what could be bought or sold.

In order that statistics may give a good working idea of probable production, it is necessary that the data given should approximate the

truth. In this alone lies the real value of statistics. The value, therefore, of our crop and live-stock reporting service is in strict accordance with the veracity of the data given by our correspondents, who are, we may say, the real agents and representatives in this work. The better and more exact their information, the more valuable are our statistics to the farmers, brokers, and merchants. The Government created this service especially for the agriculturists, therefore it remains for them to see that it is useful and beneficial.

Fortunately an Act has just taken effect, compelling the exclusive use of the metric system. This might give rise to some difficulties at first, but we feel sure that once in general use it will constitute a beneficial factor, especially to the agriculturists who have to deal with it.

For the information of the public in general and our correspondents in particular, we insert in the last pages of this number of the REVIEW a tabulated statement giving the area planted and crops of rice harvested during the year 1908. As soon as the work of compiling is completed we shall also publish similar statements on other agricultural products and live stock.

We request those who voluntarily help us in this work to write to us whenever they have any questions to ask regarding agricultural matters, as we wish to help them as much as possible.

STATISTICS ON RICE IN THE PHILIPPINE ISLANDS.

Province.	Amount of paddy produced in 1908.	Area cultivated in 1908.
	Cavans.	*Hectares.*
Agusan	1,000	29
Albay	82,000	7,000
Ambos Camarines	169,000	26,000
Antique	170,000	13,000
Bataan	246,000	3,000
Batangas	224,000	30,000
Benguet	12,000	1,000
Bohol	129,000	44,000
Bulacan	996,000	49,000
Cagayan	56,000	15,000
Capiz	614,000	56,000
Cavite	432,000	88,000
Cebu	35,000	8,000
Ilocos Norte	319,000	27,000
Ilocos Sur	339,000	28,000
Iloilo	313,000	69,000
Isabela	1,000	1,000
La Laguna	301,000	47,000
La Union	167,000	30,000
Lepanto-Bontoc	110,000	10,000
Leyte	173,000	22,000
Mindoro	22,000	3,000
Misamis	50,000	2,000
Moro	30,000	3,000
Nueva Ecija	568,000	67,000
Nueva Vizcaya	42,000	7,000
Occidental Negros	302,000	18,000
Oriental Negros	25,000	2,000
Palawan	193,000	5,000
Pampanga	557,000	45,000
Pangasinan	1,080,000	115,000
Rizal	162,000	6,000
Samar	77,000	6,000
Sorsogon	50,000	13,000
Surigao	52,000	3,000
Tarlac	1,442,000	183,000
Tayabas	219,000	24,000
Zambales	467,000	17,000
Total	10,227,000	1,093,029

CROPS PLANTED AND HARVESTED AND CONDITION OF SAME TAKEN FROM MONTHLY CROP REPORTS FOR THE MONTH OF DECEMBER, 1908.

[RICE.—This article is in the unhulled state.]

Province and crops.	Planted during month.	Condition.	Harvested during month.		
			Area.	Quantity.	Unit.
Agusan (reports from 1 town):	*Hectares.*		*Hectares.*		
Rice		Good		100	Cavans.
Abaca		do		314	Piculs.
Coconuts		do			
Corn		Poor		150	Cavans.
Albay (reports from 9 towns):					
Coconuts		Good		621,000	Nuts.
Abaca	9	do	3,894	16,202	Piculs.
Sugar cane	5	Fair	18	14	Do.
Rice	570	Good	30	525	Cavans.
Ambos Camarines (reports from 21 towns):					
Rice	1,862	do	3,383	56,272	Do.
Abaca	105	do	2,995	11,710	Piculs.
Coconuts		do		988,600	Nuts.
Sugar cane	48	do	85	110	Piculs.
Antique (reports from 6 towns):					
Rice	10	do	542	8,130	Cavans.
Abaca	2	do			
Coconuts		do		8,003	Nuts.
Sugar cane	100	do	50	1,175	Piculs.
Bataan (reports from 5 towns):					
Rice	70	Fair	1,452	44,520	Cavans.
Coconuts		Good			
Corn		do			
Batangas (reports from 13 towns):					
Rice			425	12,350	Do.
Abaca		do	13	40	Piculs.
Corn	319	Fair		15	Cavans.
Sugar cane	10	Good	10		
Benguet (reports from 4 towns):					
Sugar cane		Fair			
Rice		do	26	349	Do.
Coffee		do	2	16	Arrobas.
Bohol (reports from 16 towns):					
Coconuts		Good		2,122,595	Nuts.
Corn	23	Fair	842	10,284	Cavans.
Rice	17,897	Good	626	6,032	Do.
Abaca	8	do	54	184	Piculs.
Bulacan (reports from 14 towns):					
Rice	1,925	Fair	30,151	282,200	Cavans.
Sugar cane	500	do	18		
Corn	20	do	20	2,100	Do.
Coconuts		do			
Cagayan (reports from 4 towns):					
Rice		do	7	280	Do.
Coconuts		Good		2,000	Nuts.
Sugar cane		do			
Corn	100	do			
Capiz (reports from 13 towns):					
Rice	1	Fair	415	11,985	Cavans.
Abaca	5,059	do	25	194	Piculs.
Coconuts		Good		121,600	Nuts.
Corn	5	Fair	12	150	Cavans.
Cavite (reports from 6 towns):					
Rice		Good	484	9,650	Do.
Sugar cane		do	4	120	Piculs.
Corn	41	Fair	1	2	Cavans.
Abaca		do	12	124	Piculs.

Crops planted and harvested and condition of same taken from monthly crop reports for the month of December, 1908—Continued.

Province and crops.	Planted during month.	Condition.	Harvested during month.		
			Area.	Quantity.	Unit.
Cebu (reports from 21 towns):	*Hectares.*		*Hectares.*		
Rice	813	Good	1,065	17,021	Cavans.
Abaca	50	do	406	915	Piculs.
Corn	23,298	do	22,080	60,219	Cavans.
Coconuts		do		698,054	Nuts.
Ilocos Norte (reports from 6 towns):					
Rice		do	12,525	363,000	Cavans.
Coconuts		do		5,000	Nuts.
Sugar cane	67	do	51	500	Piculs.
Corn	9	do	2	3	Cavans.
Ilocos Sur (reports from 18 towns):					
Rice		Fair	20,552	175,988	Do.
Sugar cane	91	do	258	1,840	Piculs.
Corn	321	do	13	5,002	Cavans.
Coconuts		do		54,200	Nuts.
Iloilo (reports from 14 towns):					
Rice	6,500	Good	20,717	89,600	Cavans.
Coconuts		do		40,665	Nuts.
Corn	552	do			
Sugar cane	25	do	32	580	Piculs.
Isabela (reports from 3 towns):					
Rice	1,000	Fair	1,000		
Corn		Poor			
Tobacco	548	do	548		
Sugar cane	3	Fair	3		
La Laguna (reports from 14 towns):					
Rice	6,011	do	1,983	39,590	Cavans.
Corn	250	do	6	50	Do.
Coconuts		Good		700,000	Nuts.
Abaca	986	do	5	5	Piculs.
La Union (reports from 10 towns):					
Rice		do	12,910	112,617	Cavans.
Coconuts		do		62,800	Nuts.
Sugar cane	32	do	29	480	Piculs.
Tobacco	1,082	do			
Lepanto-Bontoc (reports from 10 towns):					
Rice		Fair	4,793	70,606	Cavans.
Corn	25	do			
Tobacco	27	do			
Sugar cane	26	do	25	400	Piculs.
Leyte (reports from 14 towns):					
Rice	184	do	957	11,742	Cavans.
Abaca	27	Good	1,637	10,100	Piculs.
Coconuts		do		419,453	Nuts.
Corn	503	Fair	665	9,840	Cavans.
Misamis (reports from 6 towns):					
Rice		Good	310	6,350	Do.
Abaca	27	do	240	2,662	Piculs.
Coconuts		do		538,492	Nuts.
Corn		do	300	2,700	Cavans.
Moro (reports from 2 towns):					
Abaca	5	do	50	651	Piculs.
Coconuts		do		25,000	Nuts.
Sugar cane	1	do	80		
Corn	10	do	50	300	Cavans.
Nueva Ecija (reports from 16 towns):					
Rice		do	22,663	699,150	Do.
Sugar cane	68	do	40	645	Piculs.
Tobacco	93	do			
Corn	14	do			
Nueva Vizcaya (reports from 1 town):					
Rice		Fair			
Sugar cane		do			
Tobacco		do			
Corn		do			
Occidental Negros (reports from 13 towns):					
Sugar cane	2,755	Good	8,505	175,350	Do.
Rice		Fair	4,335	56,800	Cavans.
Coconuts		Good		217,700	Nuts.
Corn	665	do	90	3,250	Cavans.

Crops planted and harvested and condition of same taken from monthly crop reports for the month of December, 1908—Continued.

Province and crops.	Planted during month.	Condition.	Harvested during month.		
			Area.	Quantity.	Unit.
Oriental Negros (reports from 10 towns):	*Hectares.*		*Hectares.*		
Rice	350	Fair	582	4,204	Cavans.
Abaca	151	Good	214	2,382	Piculs.
Coconuts		do		863,890	Nuts.
Corn	1,465	Fair	570	4,667	Cavans.
Palawan (reports from 1 town):					
Rice			45	50,000	Do.
Coconuts				40,000	Nuts.
Pampanga (reports from 8 towns):					
Rice		Good	5,946	49,500	Cavans.
Sugar cane		do	118	1,240	Piculs.
Corn	10	Fair			
Pangasinan (reports from 25 towns):					
Rice	2,000	Good	52,748	746,856	Cavans.
Coconuts		do		144,285	Nuts.
Sugar cane	160	do	325	7,770	Piculs.
Corn	140	do	28	520	Cavans.
Rizal (reports from 14 towns):					
Rice		Fair	26,462	140,170	Do.
Sugar cane		do	214	350	Piculs.
Abaca		Good			
Corn	13	do	5		
Samar (reports from 16 towns):					
Rice	1,103	do	560	2,053	Cavans.
Abaca	16	Fair	2,087	7,981	Piculs.
Coconuts		do		118,960	Nuts.
Sugar cane	3	do	8	40	Piculs.
Sorsogon (reports from 16 towns):					
Rice	9,946	do	3,702	3,864	Cavans.
Abaca	830	do	7,677	11,051	Piculs.
Coconuts		do		186,550	Nuts.
Sugar cane	20	do	71	3,030	Piculs.
Surigao (reports from 1 town):					
Rice	945				
Tarlac (reports from 9 towns):					
Rice	1	Good	55,555	601,300	Cavans.
Sugar cane	7	do	86	8,470	Piculs.
Tobacco	82	do			
Corn	9	do	4	200	Cavans.
Tayabas (reports from 14 towns):					
Rice	8,912	do	743	9,550	Do.
Abaca	3,261	do	99	311	Piculs.
Coconuts		do		2,717,254	Nuts.
Sugar cane	34	do	27	6	Piculs.
Zambales (reports from 4 towns):					
Rice		do	2,094	67,820	Cavans.
Coconuts		do		25,300	Nuts.
Sugar cane	7	do	29	600	Piculs.
Maguey	5	do	10	20	Do.

RANGE OF PRICES OF PHILIPPINE AGRICULTURAL PRODUCTS.

Highest, lowest, and average prices of rice, abacá, copra, sugar, tobacco, and corn for the month of December, 1908.

Province.	Rice, unhulled, per cavan.			Abacá, per picul.			Copra, per picul.		
	Highest.	Lowest.	Average.	Highest.	Lowest.	Average.	Highest.	Lowest.	Average.
Agusan				₱7.50	₱7.50	₱7.50	₱7.50	₱7.50	₱7.50
Albay	₱3.86	₱2.00	₱2.93	9.00	6.00	7.50	7.00	4.25	5.62
Ambos Camarines	5.00	1.50	3.25	15.00	4.50	9.25	7.75	4.00	5.87
Antique	2.50	1.75	2.12	22.00	12.00	17.00	6.00	6.00	6.00
Bataan	2.50	1.50	2.00						
Batangas	4.00	2.00	3.00	14.00	12.00	13.00			
Benguet	4.50	3.00	3.75						
Bohol	3.50	1.50	2.50	13.75	5.00	9.37	8.00	6.00	7.00
Bulacan	2.90	1.75	2.32						
Cagayan	4.50	3.00	3.75						
Capiz	3.55	1.30	2.42	16.30	10.00	13.15	7.00	5.00	6.00
Cavite	3.50	2.30	2.90	17.00	16.00	16.50			
Cebu	3.80	1.90	2.85	18.00	10.00	14.00	9.87	6.00	7.93
Ilocos Norte	5.00	2.50	3.75				8.00	8.00	8.00
Ilocos Sur	4.50	3.00	3.75						
Iloilo	4.50	1.50	3.00	20.00	16.00	18.00	8.00	6.00	7.00
Isabela	3.75	3.75	3.75						
La Laguna	3.50	2.50	3.00	17.00	8.00	12.50	6.00	5.00	5.50
La Union	3.00	2.00	2.50				8.00	6.00	7.00
Lepanto-Bontoc	5.00	2.50	3.75				6.50	6.50	6.50
Leyte	3.50	2.50	3.00	15.00	6.50	10.75	7.50	2.25	4.87
Misamis	3.30	2.00	2.65	14.00	7.30	10.65	7.50	7.00	7.25
Moro	2.00	2.00	2.00	15.00	10.00	12.50	7.00	7.00	7.00
Nueva Ecija	4.00	1.00	2.50						
Occidental Negros	3.75	2.00	2.87	15.00	11.00	13.00	8.00	5.00	6.50
Oriental Negros	5.00	2.50	3.75	15.00	7.00	11.00	10.00	6.50	8.25
Palawan	2.50	2.50	2.50				5.50	5.50	5.50
Pampanga	2.80	2.00	2.40						
Pangasinan	4.50	2.50	3.50				7.00	5.00	6.00
Rizal	3.00	2.00	2.50	8.00	8.00	8.00			
Samar	4.50	2.50	3.50	15.00	10.00	12.50	6.50	4.50	5.50
Sorsogon	3.75	2.00	2.87	16.00	5.00	10.50	6.50	2.00	4.25
Surigao	3.00	3.00	3.00	11.50	11.50	11.50	7.50	7.00	7.25
Tarlac	4.00	1.50	2.75				7.00	6.00	6.50
Tayabas	4.00	2.50	3.25	17.00	5.00	11.00	6.00	2.00	4.00
Zambales	2.50	1.50	2.00				6.00	2.00	4.00

Highest, lowest, and average prices of rice, abacá, copra, sugar, tobacco, and corn for the month of December, 1908—Continued.

Province.	Sugar, per picul.			Tobacco, per quintal.			Corn, per cavan.		
	Highest.	Lowest.	Average.	Highest.	Lowest.	Average.	Highest.	Lowest.	Average.
Agusan							₱2.00	₱2.00	₱2.00
Albay	₱8.00	₱8.00	₱8.00				3.00	3.00	3.00
Ambos Camarines	8.25	4.00	6.12				4.00	1.50	2.75
Antique	2.70	2.70	2.70	₱22.00	₱22.00	₱22.00	2.00	1.50	1.75
Bataan									
Batangas	4.00	3.00	3.50				3.00	2.00	2.50
Benguet	4.00	4.00	4.00						
Bohol	5.00	3.50	4.25	20.00	20.00	20.00	3.50	1.50	2.50
Bulacan	7.00	5.00	6.00	17.00	9.00	13.00	3.12	2.00	2.56
Cagayan				10.00	10.00	10.00	3.50	3.00	3.25
Capiz	5.00	5.00	5.00	15.00	5.25	10.12	2.00	1.50	1.75
Cavite	3.70	2.50	3.10				2.30	1.50	1.90
Cebu	8.00	2.50	5.25	30.00	3.00	16.50	4.50	2.25	3.37
Ilocos Norte	8.00	2.00	5.00	19.00	4.00	11.50	3.00	2.50	2.75
Ilocos Sur	6.00	2.00	4.00	35.00	7.00	21.00	4.00	2.50	3.25
Iloilo	6.00	2.50	4.25	30.00	5.00	17.50	4.00	2.50	3.25
Isabela				10.00	10.00	10.00	2.50	2.50	2.50
La Laguna	6.50	3.00	4.75				5.00	2.50	3.75
La Union	6.00	3.00	4.50	9.00	9.00	9.00	3.00	3.00	3.00
Lepanto-Bontoc	3.00	2.50	2.75	8.00	8.00	8.00			
Leyte	7.00	3.00	5.00	50.00	16.00	33.00	3.00	2.50	2.75
Misamis	4.00	4.00	4.00	25.00	9.00	17.00	3.25	1.50	2.37
Moro	5.25	5.25	5.25				2.50	2.50	2.50
Nueva Ecija	7.50	2.00	4.75	12.00	7.00	9.50	2.00	1.50	1.75
Occidental Negros	4.50	3.25	3.87	35.00	30.00	32.50	3.00	2.00	2.50
Oriental Negros	3.00	3.00	3.00	25.00	7.00	16.00	4.00	2.50	3.25
Palawan									
Pampanga	6.00	3.80	4.90				2.25	1.50	1.87
Pangasinan	7.00	3.00	5.00	10.00	6.00	8.00	5.00	1.50	3.25
Rizal	6.00	3.75	4.87				2.00	2.00	2.00
Samar	7.50	3.00	5.25				3.00	3.00	3.00
Sorsogon	5.00	2.00	3.50	12.00	12.00	12.00	1.50	1.50	1.50
Surigao									
Tarlac	5.00	1.50	3.25	7.00	7.00	7.00	2.00	2.00	2.00
Tayabas	6.00	3.00	4.50	6.00	6.00	6.00	5.00	5.00	5.00
Zambales	8.00	8.00	8.00	25.00	25.00	25.00	2.00	2.00	2.00

PLATE I. MANILA HEMP GROWING IN THE FIELD.

THE PHILIPPINE

Agricultural Review

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EDITORIAL.

THE THEOBROMA CACAO.

The attention of the readers of this number of the REVIEW is invited to the article on the cultivation of *Theobroma cacao,* or cocoa, by A. Fauchère. The world's market for cacao is at present supplied principally by South and Central America, the Antilles, Equador, Venezuela, Trinidad, the Guianas, Brazil, and Mexico. None of this product is exported from the Philippines, and the industry of growing cacao for home consumption is not well established. Practically all of the cacao beans gathered in different parts of these Islands are fermented and worked up into little balls or cakes which are used by well-to-do Filipino and Spanish families. However, the native cacao found in the tiendas of most towns is usually a very inferior article and many of the wealthier

families buy the cacao beans and make their own chocolate by crushing the beans with an iron or stone roller on a large stone made specially for this purpose. While crushing the beans, sugar and spices are mixed with them to give the desired flavor to the paste or butter produced, which when heated and diluted with water and milk makes the native drink called "chocolate."

There is but one chocolate factory of any importance in the Philippines and this is supplied with beans principally from Java, Ceylon, and America. Only very small quantities of cacao beans are furnished to the Manila market from Cebu, Laguna, Batangas, Mindanao, and other provinces. Cocoa, chocolate, and other forms of the cacao of commerce to the value of ₱423,312 were shipped into the Philippines last year, and at present there seems to be no good reason why this product should not be supplied by home producers and the cocoa and chocolate for home consumption prepared in home factories; if, in fact, cacao should not become an important export of these Islands, supplying a part of the demands of the world's market.

M. Fauchère is, without doubt, one of the best authorities on cacao culture. He writes interestingly and in detail on the subject and what he says should be of value to any one interested in this industry. This article will be continued in a later number of the REVIEW.

THE PHILIPPINES CARNIVAL.

The second Philippines Carnival has come and gone. The carnival is one of the most popular indications of harmony and progress in this country, and as such is deserving of great praise and credit. All nationalities in Manila and the provinces contributed to and enjoyed the Carnival to the fullest extent. There were no distinctions of race, color, or nationality. On the Carnival grounds all were on an equal footing and those race discriminations which in time past have so often been the occasion of embarrassments were, for the time being at least, forgotten. For bringing about better harmony between all residents in the Philippines, the Carnival deserves great credit.

This year more than ever before the Carnival has done much to break down the barrier of prejudice which has in past years been built up against us in the leading cities of the China coast. Our English neighbors have, for once at least, admitted that we are making good progress in the work of colonization, and have enthusiastically put themselves on record as saying that they will watch our future progress with greater interest and sympathy. The 1909 Carnival has made some genuine friends and sympathizers amongst our English neighbors. To this extent, the Carnival is bringing about harmony in the Far East, and there is being gradually built up a bond of sympathy in place of the barrier of prejudice between the nations responsible for progress in this part of the Orient.

The orientals are beginning to realize that the white peoples are really their friends and brothers, striving to bring to them the best things of western civilization. For this the Carnival deserves great credit, and its officials should be encouraged to greater achievement along these lines. The interest and coöperation of Hawaii, Japan, China, the Straits Settlements, Dutch East Indies, and Australia should be secured; all of whose interests and efforts are along similar lines to those of our own, and with whom we should work in sympathy and harmony for the best and largest results in commercial progress and civilization.

For us in the Philippines, the Carnival must have some substantial foundation and reason for our work and efforts; these, we believe, are primarily the industrial development of the resources of our own country—the Philippines. Otherwise, we can not hope to attract to our shores in large numbers each year our oriental neighbors. It is to be regretted that a larger number of the provinces did not take part in the Carnival and furnish exhibits of the products of their farms, shops, and factories this year. The Provinces of Pampanga and Bulacan, also the Moro Province, were represented with most creditable exhibits. Next year we hope that not less than twelve provinces will be represented, for only as the provinces take an interest and take part in the Carnival can it serve its highest purpose and be the success it should. The Carnival must be distinctly a Philippine Islands' carnival and not a Manila carnival in order to serve its purpose to the whole people. The REVIEW suggests the employment in the future of provincial agents to explain to the officials and the people in the provinces the benefits of the Carnival, and to secure their coöperation. Let the Carnival of 1910 be more truly a Philippine Islands' carnival in which the provinces take a leading part and have a controlling interest.

GOVERNMENT FARMS.

One of the best material evidences of the determination of the Island Government to encourage the development of agriculture is the establishment of Government farms and experiment stations, where certain important experiments in tropical agriculture are given a thorough trial and the farmers in the surrounding country are given the benefit. These farms and stations are actual demonstrations of progressive methods of agriculture, stock raising, and the lines of agricultural work in which the farmers of the respective sections are engaged.

In this connection, the article in this number of the REVIEW on the Government farm at San Ramon, which is now under the administration of the military government of the Moro Province, will be of interest and serve to give our readers an idea of the work and activities of one of these farms. This Bureau has established farms or agricultural experiment stations at La Trinidad, Benguet, in charge of Mr. M. C. Merrill;

La Carlota, Occidental Negros, in charge of Mr. F. E. Deason; Alabang stock farm, Rizal, in charge of Mr. H. J. Gallagher; Lamao Experiment Station, Bataan, in charge of Mr. Harold Cuzner; and the Baguio stock farm, at La Trinidad, Benguet, in charge of Dr. C. M. Morgan. Farmers living in the vicinity of any of these farms or stations are urged to visit them frequently, and to make known to the superintendent their difficulties in raising various crops, and to seek their coöperation in every possible way. In this way only can the Government experiment stations and farms fulfill their purpose and be the help they are intended to be to our Filipino farmers, who are the real source and foundation of the country's future wealth and prosperity.

AGRICULTURAL LITERATURE.

The attention of our readers is called to the list of periodicals now being received by the library of this Bureau, which appears on the last page of this number of the REVIEW. These periodicals are published in several different languages, many of them being in English, a number in Spanish, and some in French, Dutch, and German, covering the principal agricultural publications which can be obtained from the different Governments interested in tropical agriculture. An effort is being made to make the library as valuable and practical as possible. Late numbers of the periodicals mentioned in the list will be found on the tables in the library at the office of this Bureau, together with bulletins and pamphlets, published by the various branches of the United States Department of Agriculture, also by many of the leading colleges and experiment stations in the different States. There are a number of catalogues that may be of interest to agriculturalists, and everyone interested in this literature is cordially invited to visit the library where he will be welcome, and every assistance possible will be given in looking up literature along any line of agricultural research or progress.

RICE PLANTING IN HAWAII.[1]

During the season of 1907 the Hawaiian experiment station conducted some experiments in rice-growing which confirm conclusions reached by this Bureau that are of great interest to planters in these islands.

One of the most interesting of these experiments and one which gave a definite result was that undertaken to test the relative value, for Hawaiian conditions, of two distinct methods of planting; viz., the direct sowing of seed, as practised in southern United States, and the eastern method of transplanting which, as already mentioned, is generally adopted in Hawaii. Seed was broadcasted at the rate of 50 pounds an acre, and another lot of the same stock of seed was drilled in rows at the same rate. When well established the seedlings were thinned out to a stand of approximately 200,000 plants per acre, thus conforming as closely as possible with the number of transplanted plants per acre. One adjacent plot was set out with seedlings 20 days old at transplanting, and a second plot with seedlings 35 days old at transplanting. By far the best return of all—viz., 4,205 pounds of paddy and 4,024 pounds of straw per acre—was given by the plot planted with the seedlings 20 days old at transplanting. The cash value of the paddy return per acre from this plot was $105.12. The plot planted with the older seedlings and that on which the seed was drilled gave returns very nearly equal, but about $56 less in value than the return from the best plot. The plot on which the seed was broadcasted gave a return of slightly less value than the plot which was drilled.

[1] *Agricultural News*, Vol. VII., No. 164, August, 1908.

THE SAPODILLA TREE (CHICO).[1]

The sapodilla tree (*Achras sapota*), called the naseberry in Jamaica, is a native of Mexico and other parts of Central America, where it is known as the "Zapote chico," and is much valued on account of its different products.

The tree grows from 25 to 30 feet in height. It is very plentiful in some districts of Mexico, and its wood gives a most valuable timber. The wood of the sapodilla is of a clear, deep, reddish-brown color, very hard, but fairly easy to work until thoroughly seasoned, when only the finest edged tools have any effect on its surface. The grain is of such density that the wood sinks when placed in water. The British consul at Vera Cruz mentions that door frames and other interior work in houses, known to be over a century old, made from the wood of the "Zapote," are as good to-day as when first placed in position.

Experiments in the use of the timber in port construction, for forming supports under sea water, show that it is extremely valuable for this purpose, since, notwithstanding the influence of the water and the mud, the timber appears practically indestructible. In Central America the milky juice yielded by the tree on tapping the bark is evaporated and forms the chicle gum of commerce. The business of producing this chicle has become a large and prosperous one in Mexico; the amount exported in the past year being over 2,200 tons, valued at more than $2,000,000, Mexican currency. There is also an increasing output of chicle from British Honduras. This product is chiefly shipped to the United States, where it is used as the basis of chewing gum.

The sapodilla fruit is said to be much appreciated in America, and it stands shipment well. The trees are readily propagated by budding.

[1] *Agricultural News*, Vol. VII., No. 164, August, 1908.

THE VALUE OF HUMUS.

By Charles Beelar.

The most important fact about humus is that it is the principal source of the supply of nitrogen in soils. The Minnesota experiment station has found that an increase of 0.5 per cent of humus in soils means an increase of 245 pounds of nitrogen to each acre. On the other hand, if the supply of humus is allowed to decrease 0.3 per cent in four years, there is an annual loss of 146 pounds of nitrogen per acre over and above the amount removed in the crop. This shows conclusively that increasing the amount of humus in the soil increases the amount of the nitrogen in the soil; and the decrease of humus means a great loss of nitrogen, not only by being removed in the crop but by leaching away in the drainage waters and by escaping into the air as the humus decays.

Scientists tell us that the humus in soils is never devoid of nitrogen. This is especially true with the soils in arid sections. The humus of soils in New England, which had been farmed for years but had been kept in properly rotated crops was found to have from 4 to 5 per cent of nitrogen. The humus of the arid soils of California was found to contain as high as 16 per cent of nitrogen; while in the semiarid regions of Kansas, Colorado, and Texas the amount of nitrogen in the humus has been as high as 10 to 12 per cent.

The reason that humus contains nitrogen may be better understood when we know that the most of it in soils comes directly from albuminoids in organic matter. While it is true that a little of the nitrogen may be derived from the reduction of ammonium salts and nitrates, the most of it in soils comes from the albuminoids that at one time formed a part of the plants and animals that lived upon the soil. You can not deposit upon the soil an organic substance, whether it be from plant or animal life, that does not contain nitrogen in a greater or less amount. When the organic matter decays, the supply of available nitrogen in the soil is increased.

We have found that nitrogen is needed to promote the growth of plants; that if there is not a sufficient amount of nitrogen in the soil we can not have plants. Since this is true and since practically all of the nitrogen in soils comes from its humus content, we can see the absolute

necessity of humus in soils. All plants, except legumes, obtain their nitrogen from the soil. Legumes have the power to gather this element from the great store in the air, if there is not enough in the soil to promote their growth. Since plants must obtain their nitrogen from the soil and the soil's supply is obtained principally from humus, we can again see the importance of humus.

1. Nitrogen is the most expensive of the three elements needed by all plants. To grow the common crops more of it is needed than any of the three plant foods. Since it is the most expensive of plant foods and so much of it is needed in the production of crops, and its supply can be maintained without any material cash outlay, if we maintain the supply of humus, we can again see the great value of humus in the soil.

2. The presence of humus in soils promotes chemical action on the mineral elements in the soil which are not available at the time for the needs of the plants. The soil may be rich in phosphorus or potash, yet nearly all of these elements may be unavailable for the needs of the plant: they may not be in a state to be utilized so that the growth of the plant will be very slow. If the soil is rich in humus, the acids contained in the humus together with those of the character of crenic and apocrenic acids will act upon the insoluble elements and make them available for the plant.

3. Besides being the source of nitrogen and rendering the mineral elements already in the soil available, the application of humus adds plant food to the soil. Not only do all organic materials add nitrogen, but they all contain a greater or less amount of the other plant foods needed to make soils rich. This is especially true of manures voided by animals raised on the farm. Horses, cattle, hogs, sheep, and poultry void manure rich in nitrogen, phosphoric acid, and potash. The degree of richness, of course, will depend on the animal and the kind of feed and attention received. If the manure of these animals is added to increase the supply of organic matter, the supply of all three plant foods is increased by the amount applied in the manure.

4. Another influence that humus has on the fertility of soils is the fact that it increases the number of earth worms. The farmer's son who wishes to go fishing does not get his bait from the clay bank on the hillside; he knows that no fish worms can be found there. Instead he goes out behind the barn, where the manure has been thrown for years, and there in the black earth, rich in humus, he digs down and finds the worms. Earth worms of all kinds make their home in soils rich in organic matter. Their presence greatly increases the supply of available plant food. And in some cases they burrow down into the subsoil and on their return bring up a little of the mineral elements to increase the supply in the surface layer. This may seem like a very insignificant matter; but, after all, it is the little things that count in the fertility of soils. This is one of the little things.

5. Besides being valuable by directly increasing the supply of nitrogen and indirectly increasing the available supply of other plant foods, humus benefits the mechanical condition and texture of the soil. Soils rich in humus are better retainers of moisture than those with but little humus. This property of soils containing humus is of special importance in arid and semiarid countries. Where there is but little rainfall during the months when crops make their heaviest growth, it is important that the soil have the power to contain and retain moisture as long as possible. If the soil can not contain much moisture, no matter how much it rains before the dry weather comes, the excess moisture will drain off and just what the soil can contain is all the crop will have to draw from in the time of dry weather. If the soil can contain a considerable amount of moisture and has the power to retain it, there is a greater probability of saving the crop when the dry weather arrives.

Experiments show that soils rich in humus have the power to contain more moisture than soils deficient in it. This is true because pure humus will contain more moisture than sand or clay, and the more humus there is in a soil, the more moisture it can contain. It has been found that 100 pounds of sand will contain only from 25 to 29 pounds of water. If any more than this amount is applied it will leach through and pass off in the drains. One hundred pounds of clay will contain from 40 to 50 pounds; 100 pounds of garden earth, from 85 to 90 pounds; while 100 pounds of pure humus will contain as high as 190 pounds of water. In other words, the soil of a garden, rich in humus, will contain nearly four times as much moisture as sandy soil devoid of humus.

Not only is the soil rich in humus a better container of moisture, but it is also a better retainer. Experiments show that 88 per cent of the moisture in sandy soils will evaporate in four hours in hot dry weather such as is usually experienced in arid countries.

In garden loam, reasonably rich in humus, only 21 to 25 per cent will evaporate in that time. In other words, the garden loam will contain almost four times as much moisture as the sand bank and retain it almost four times as long. Since evaporation may be hindered by establishing a dirt mulch, and since a dirt mulch is more easily established in a mellow soil, rich in humus, it can be seen how valuable organic matter is to the soil in semiarid regions.

In addition to the above, humus causes the water in soils to rise nearer to the surface. Experiments show that farmyard manure will strengthen the capillary rise of soil moisture. King tells of an experiment where it was found that the surface foot of 1 acre of manured soil contained over 1 per cent more moisture than the same soil unmanured. This proves that the moisture in soils rich in humus rises to the surface. This experiment showed that there were over 15 tons more moisture in

the surface foot of an acre of manured land than in the same soil unmanured, while there were nearly 7 tons less moisture in the fifth foot below the surface of the manured soil than in the unmanured soil. The humus brought the moisture up where the crops could use it. Not only then does the soil rich in humus contain and retain more moisture, but it places the moisture where it will most benefit the crop.

Every farmer knows that the above is true. He knows that the garden plot will be moist long after the clay bank has dried out and become so hard that it can not be plowed. The reason lies in the fact that the garden contains a greater amount of humus and will contain more moisture and keep it longer than the clay bank will. Therefore the farmer, who would make it possible for his crops to get moisture longer in a dry time should increase the supply of humus or organic matter in the soil.

6. Then, too, organic matter makes the soil warmer. This may not seem important in southern soils, but nevertheless it is beneficial. It is especially important in the germination of the seed of early crops. The soil that will warm up first in the early spring will, in the majority of cases, make the farmer a larger profit than the soil that is backward about becoming warm.

Humus makes soils warmer for two reasons. First, it makes them dark in color; therefore the soil will absorb more heat than the lighter-colored soils. Black, well-drained soils will warm up earlier in the spring than light-colored soils. Second, the decay of the humus warms the soil. Wherever vegetable matter decays, there is a certain amount of heat generated. Consequently, those soils that contain a great deal of decaying humus will be warmer than the soils without humus. The decay of any substance is, after all, nothing more or less than slow burning. When anything burns, it produces heat. That humus warms every soil, the farmer is aware. Compare the garden plot in early spring with the clay bank and you can soon tell that the garden plot is ready to germinate seed several days before the clay bank.

7. Humus decreases the weight of soils. That is, it makes soils lighter and more easily cultivated. Rich garden soils weigh about 70 pounds per cubic foot; clay soils, about 90 pounds. The lighter the soil the easier it is to cultivate and the less liable it is to pack. It is more easily cultivated to establish the much-needed dirt mulch and to enable the plant to send its roots deep down into the soil.

THE GOVERNMENT FARM AT SAN RAMON.[1]

By Capt. WILHELM J. WHITE, *Superintendent.*

In 1866 an order was issued by the Spanish Government creating a commission to devise means for utilizing convict labor in the Philippines. The plan adopted contemplated a number of penal colonies, but for some reason only one was established and that, after much deliberation, was located on the coast 15 miles north of Zamboanga, and named San Ramon Blanco y Erenas, for the ranking military officer of Mindanao, later known as General Blanco of Cuban fame. The colony struggled along for many years making some progress in experimental work but suffering from mismanagement.

The original site had as its natural boundaries Talasayan River on the south, Lubugan River on the north, with the high range of mountains on the east, and the Pacific Ocean on the west. Aside from these boundary rivers, another, the River Sax, which rises far up among the mountains, crosses the immense tract of land and empties its clear, fresh water into the sea through four splendid estuaries. This river is the chief water supply of the colony.

Without waiting for approval of plans, an overseer was temporarily appointed late that same year, and prisoners from Zamboanga were sent out as laborers. They immediately set about clearing ground near the beach for cultivation, and building storehouses for the produce when harvested.

With all of these hopeful signs at the beginning, it was yet the land of "*mañana,*" and the final celebration of the founding of the colony was not held until August 31, 1870.

For long years San Ramon was destined to be a center of experiments in the manner of government as well as in the variety of products.

The plan was that the governor of the colony be the commander of the Mindanao prison establishment, with an agricultural assistant who was to reside at the farm and receive ₱60 per month and one-fourth of the products of the farm. The laborers were all to be prisoners.

Later a captain of the Army was appointed director. In 1883 this

[1] From the *Mindanao Herald,* Vol. VI, No. 2, Feb. 3, 1909.

captain of the Army was given sole charge of the farm, prisoners, and military detachment stationed there as guard; but, in case of necessity he might appeal to his immediate superior, the commanding general of Mindanao.

Don Felipe Dujioles, a captain of infantry and an agricultural expert, was later appointed director. He had studied for the degree of agricultural engineer, but failed to complete his course owing to the breaking out of the war in Spain in 1876. The work under his supervision was carried out in a proper manner; and it was owing to his untiring efforts that a sugar mill was erected with an alleged capacity of 6,000 piculs per day, and a sawmill with a daily output of 800 cubic meters of lumber.

During the administration of Don Felipe, the boundaries of the farm were somewhat extended, until it included 2,000 hectares. Other changes were made in 1889, and again in 1894, when a lieutenant-colonel was appointed technical director, who was also required to be an engineer. He chanced to be, fortunately, a laborious and conscientious man, and under his direction the colony recovered from the miserable condition that had previously existed.

Fifty prisoners were put to work, and they cleared ground for new buildings, laid out new fields and planted corn, and later indigo, cotton, tobacco, sweet potatoes, and other useful plants. The different altitudes, kinds of soil, and the drainage system of San Ramon proved that these plants, as well as many others, can be advantageously cultivated, provided the soil is well selected and the young plants protected from the ravages of wild animals. However, all these plantings yielded rather poor returns.

Sugar cane was tried, at first only in a small way in the rude wooden mill which had been previously constructed, but the quality of the sugar was very inferior. Later a steam sugar mill was procured, through Mr. John Foreman, the historian, and the capacity and the quality increased and improved.

When the prisoners were not cultivating, harvesting, and marketing the sugar, they were employed in molding and burning brick, getting out timber, sawing lumber, building bridges and roads, and clearing new land for cultivation. On the San Ramon farm is to be found an abundance of timber of all the superior groups.

In 1899 the outbreak between the Spaniards and the people of Zamboanga took place, and that same autumn, with American occupation of Mindanao, all the prisoners of San Ramon, said to number between 1,000 and 1,600, were turned loose. All the buildings, warehouses, etc., were burned to the ground, except the sugarmill and sawmill buildings, which were of substantial material with brick pillars and corrugated iron roofing, and one or two dilapidated frame buildings near the sea. Besides these a few scattered plots of hemp and about 5,000 coconut trees, which had been planted during the past quarter century, were our inheritance.

The convicts, many of them *deportados* from other islands, some of them criminals of the worst type, and others political offenders, were liberated. Among the ignorant and depraved liberty often means license, and this proved no exception to the rule. What was to become of these men? In highly civilized, Christianized countries, the ex-convict alone knows that the hardships he faces when turned out are often greater than the lack of liberty while incarcerated. But what of men, many in a strange island, speaking different dialects, ignorant and untutored, with an inborn fear of the Moro tribes which completely surrounded them?

Sometimes with clothing too meager to be described, these poor wretches went forth about the neighboring villages and found homes, thus finally becoming an amalgamated part of the community. Many remained on the farm, as they had been there for many years and had not the ambition to begin life elsewhere. When it was explained to them that a new Government was in control, that Spain no longer held her power, they only shrugged their shoulders in that passive way and stayed on.

When the American Insular Government took charge of the farm these men were given employment. Some of them are still at their posts; others have taken up land and built homes for themselves, while others have wandered away to live without work.

Mr. George M. Havice was the first civilian superintendent appointed. He took charge late in 1901. During his administration many coconut trees and abount 75,000 hemp plants were set out. The superintendent's residence which had been begun by the military authorities—who were in control of the farm during the interim between the Spanish evacuation and the taking in charge by the Insular Government—was completed. Hemp sheds were built and nipa cottages erected for the exprisoners then employed as laborers. During the time laborers were employed their pay, together with the salary of the superintendent and a clerk, left a large deficit each year.

Upon the organization of the Moro Province in 1903, General Wood, the first governor of the province, saw great possibilities on San Ramon if economically managed. It was an easy problem to persuade the Insular Government that economically as well as geographically San Ramon should be administered by the Moro provincial government. They were as glad to lay down the burden as we were to take it up.

The writer was appointed superintendent under the new government on December 16, 1905, and has continued as its superintendent to the present time.

When General Bliss assumed command of the Department of Mindanao in 1906 and became governor of the Moro Province, his interest in agriculture was manifest from the first, and his fostering interest in

San Ramon farm has been a great incentive to its ultimate success. The uncertainty of labor proved a menace for some time, but in May, 1907, the legislative council of the province relieved the situation by sending a few Moro prisoners from the provincial prison as laborers. The experiment was a happy one, and as accommodations could be provided for them more have been utilized. A modern iron-barred and concrete-based jail has been erected, and with the opportunities of securing plenty of fresh fish, vegetables, and other wholesome food, and with good treatment, the prisoners have been well and contented with but few exceptions. Their labor has been satisfactory at all times. They have been taught to do almost all kinds of skilled and unskilled labor; among them are stone masons, carpenters, bricklayers, and blacksmiths. They have become accustomed to the use of improved farm implements, many of them being able to plow with a double yoke of oxen and an American plow. They do good work and seem to take an interest in it. Under the direction of an expert several of them have become good hemp stripers. At the present time more than three-fourths of all of the labor on the farm is done by prisoners. The regular prison wage for all the prisoners employed is paid by the farm into the provincial prison fund.

During the typhoon of September last the River Sax changed its course, and where once there stood a thriving field of hemp and young coconut trees there is now a huge basin of boulders with streams running through it. The soil was washed away to a great depth and some of the oldest bearing coconut trees on the farm went down to the sea. Along the beach great numbers of bearing trees were washed out, the sea wall was washed away, and it is hard to estimate the loss of young nuts that were blown off by the storm. For days the streams were full of young nuts washed down from the slopes.

The main object of the provincial government has not been to operate the farm as a money-making proposition, but that it should be a factor in the development of new private plantations, making the necessary experiments for the planters, furnishing them with seeds, seedlings, and plants at a less cost than they have had to pay heretofore, especial care being taken to assure their being well selected and the best in the Islands.

The seed and plant business has grown so in the past year and a half that I anticipate that over one-half of the entire coconut crop of the farm will be used for seed during this year. In the past we have been unable to furnish these seeds and plants as regularly as the planters desired them, owing to poor transportation facilities, but under the new arrangement of schedules of the subsidized steamers the facilities are excellent, the seeds and plants being carried without transhipping, from the farm direct to the planter's very door. Already we have orders booked (November 1, 1908) for over 60,000 selected coconuts for planters at Davao, Malabang, Siasi, Parang, and other places throughout the province, many of which are now ready for shipping. We have many

inquiries from capitalists in the United States regarding suitable land for coconut planting, the problem of labor, the approximate amount of capital required for the development of plantations, and if we would be able to furnish seeds in case a proposition is consummated. So that the San Ramon farm will be one of the important factors in the development of the virgin fields of the Moro Province.

That the farm has been self-supporting is not due to any increase of products over former years, but to the economical utilization of labor and to the adoption of improved implements and modern methods of operation. During the next two years the coconut crop will be greatly increased by several thousand young trees coming into bearing. General Bliss, the provincial governor, has always insisted on reinvesting the profits from the farm. So that out of the first year's profits new implements were furnished, which have greatly aided us in the farm operations. From the profits of last year mules imported from America were purchased, which are a great addition to the farm. With the increase of revenues the first addition that will be made will be the purchase of some improved breeds of calves for the purpose of live-stock raising. Arrangements are being made for the purchase of these calves, which will be immunized against all the prevailing cattle diseases, and by the time they are old enough for breeding purposes they will be thoroughly acclimated. The result can not fail to be profitable and beneficial.

We have communications regarding breeding cattle from planters throughout the province who want a good breeding animal to improve the herds of native cattle which they now own. In this way the farm will again be able to help the planters and build up a most profitable, but for many years a wholly neglected, industry.

Among the experiments at the farm is the nursery of all kinds of citrus fruit, ornamental shrubbery, shade, and other trees. It has been proven that the finest quality of citrus fruits can be grown here; that the average lemon tree bears as much fruit as in any part of the world. A tree on the farm commenced bearing in December, 1907; it has been continuously bearing ever since and we have gathered from it over 200 good lemons and will be able to gather at least 50 more. At this rate of production this tree alone would bring in a revenue of ₱12.50 a year, which is about as much as the product of six coconut trees. The demand for such fruit has never been regularly supplied by the imported product, and one can not estimate how great the demand would be if a regular supply could be furnished fresh from the trees; but it is safe to say that this can be made a profitable business with small capital on a small area. We can furnish the young trees in small quantities at any time, at the actual cost of germination; we will also gladly furnish information regarding the culture of such fruits.

THE NEW MANIHOTS.[1]

By Dr. E. C. Waterhouse.

During the last two years and especially this year great interest has been aroused in some new species of Manihot rubber trees, which from all accounts are far superior to *Manihot glaziovii,* and should be of special interest to the rubber growers of Hawaii from the fact that the *Manihot glaziovii* or Ceara rubber tree grows and yields so well in Hawaii. If these species do as well as the Ceara, it will be well worth the while of the rubber growers of Hawaii to pay particular attention to them in future plantings. Some of the reasons why will be forthcoming later in this paper.

The export of rubber from the State of Bahia has increased more than ten fold within six years, having risen from 100 tons of very inferior rubber in 1900 to over 1,100 tons of a very superior grade of rubber in 1906. This led to an investigation of the sources of this new supply and the discovery that instead of the low grade of Mangebeira, formerly gathered, the supply came mainly from three new and valuable varieties:

1. *Manihot dichotoma,* or Jiquié Manicoba;
2. *Manihot heptaphylla,* or Sao Francisco Manicoba;
3. *Manihot piauhyensis,* or Piauhy Manicoba.

These varieties were so named by Dr. Ule, so well known as an authority on the classification of the different species of rubber trees, who visited the State of Bahia and neighboring states in 1906 to look into the sources of this supply.

Until six years ago *Manihot glaziovii* was considered the only rubber yielding species of its genus, though there are 82 species recorded which will soon be 100, when all of those discovered are described. It was only in the early part of 1906 that even the Kew Gardens, the birth place, so to speak, of the rubber industry in the Far East, always on the lookout for new species of rubber, were aware of the existence of rubber-yielding trees closely related to the commonly cultivated *Manihot glaziovii.*

All of these species, from all accounts, not only yield considerably more latex than the Ceara, but what is of very much more importance in

[1] From *The Hawaiian Forester and Agriculturist* for December, 1908.

Hawaii, the amount which one man can collect is much greater; in other words, the cost of collection is considerably less. This is a most important item here owing to the high price paid for labor, and, in fact, the point upon which the whole success of the rubber industry in Hawaii hinges.

A notable fact in this connection, one which will appeal to any one who has had any experience in tapping the Ceara, is that in these new varieties, in shedding the bark, longitudinal slits are formed and the membranous bark peels off in more or less vertical rows. This allows its removal much more easily and therefore more cheaply than is the case with the Ceara.

These varieties of Manihot like the *Manihot glaziovii* or Ceara have a very dry habitat. However, as we find that here in Hawaii the Ceara does better in wet localities, the same may be true with these varieties. That the Ceara does better here where it is wet I think there is no doubt. I have myself, in a little experiment station of my own, tried watering some plants and leaving others in the same soil unwatered; the watered plants far outstripped those unwatered and seemed to have as much or more latex, though the trees are still too young to draw conclusions as to yield.

In regard to these three varieties:

(1) MANIHOT DICHOTOMA.

The seeds of this variety are much larger than those of the Ceara. Germination takes place in two to three weeks if unfiled, the shell being much softer than in the case of the Ceara. The soil upon which this tree flourishes in variously described as red clay and red loam. The bark of this tree is thinner and more delicate than that of the Ceara.

(2) AND (3) MANIHOT HEPTAPHYLLA AND MANIHOT PIAUHYENSIS.

The seeds of these two varieties can hardly be distinguished from each other; they are only a little larger than the Ceara seeds. They do not germinate nearly as well as in the case of the *Manihot dichotoma*. These two varieties in the region around Bahia thrive in a sandy soil, growing largely on sandstone mountains. Neither of these varieties grow as tall as the *Manihot dichotoma;* they are also smaller and inclined to branch low. They are not affected by the wind so much as Ceara, probably on account of being smaller and more low-lying. This also affects the methods of tapping, as explained later. The foliage is characteristically green and fresh looking.

Methods of planting.—There are a number of plantations around Bahia, some of which are now three or four years old. They are planted for the most part 1,000 trees to the acre. This close planting has been adopted because the trees are planted in a dry locality and it is claimed

that if not planted so closely, or say 200 to the acre, the ground would be baked so hard and dry that the trees would dwindle and die. Also the trees are considerably smaller than other varieties and consequently need less room.

Methods of tapping.—In the case of the *Manihot dichotoma* the bark of the trunk is tapped and an instrument curved at the tip is used. The herring-bone or a single cut is used. Cups are used to receive the latex. The latex coagulates quickly on exposure to air but apparently not too quickly to prevent its flowing down into the cups well. Water is sometimes used in the cups to prevent too rapid coagulation.

In the case of the *Manihot piauhyensis* and *Manihot heptaphylla* the shorter trunk and somewhat thinner bark than the *Manihot dichotoma* are not suitable for cutting and by this method yield little latex. A little earth, however, is scraped away from the base of the tree, the top of the taproot is exposed and an incision with a round-pointed knife is made at or near the junction of the taproot and the trunk, and the latex flowing into this hole coagulates and is gathered therefrom. Often the collectors coat this little hole with clay to keep the rubber cleaner. Cups have been used but there is some difficulty in getting them into the hole thus made and the method is little used at present in collecting from the wild trees, but will doubtless be worked out on plantations.

Yield of the trees.—This is variously stated to be all the way from $2\frac{1}{2}$ to 11 pounds per year. Though of course these statements are made in regard to the gathering of the rubber from wild trees which are more or less ruthlessly tapped, and especially in the case of the *Manihot dichotoma* the wood is thus often injured severely and the tree dies. Also it is probably wet rubber that is spoken of and in some of it, especially the *Manihot heptaphylla* and *piauhyensis,* there may be considerable dirt.

Dr. Ule considers that the *Manihot dichotoma* has the advantage of its caoutchouc bringing a somewhat higher price. On the other hand, the amount produced in the other varieties is considerably greater, according to him. He therefore prefers these latter varieties, which he considers will supplant the Ceara for the dry and less fertile areas where Ceara is cultivated. There is no doubt, however, that all of these varieties yield more than the Ceara.

Amount of latex collected by one man in one day.—This has been variously stated at from 1 to 8 or 10 pounds. Taking into consideration the tendency to exaggeration in regard to any new product and misleading methods of figuring, still it is generally conceded that considerably more can be collected in a day from these varieties than from the Ceara.

Several thousand seeds of the *Manihot dichotoma* or Jiquie Manicoba were imported by Mr. Jared Smith, and most of the rubber plantations have obtained some of these. I have planted a few of these seeds. When filed they germinated in a few days and have grown very well.

fully as well as the Ceara so far, in spite of the fact that this is the wrong season of the year for planting. The leaves have red ribs, especially when looking up through them with the sunlight shining through. Those obtained at the Kew Gardens had whitish green ribs which, it has been suggested, might be due to artificial cultivation there. I intend to try watering some of the trees very heavily and letting others have only the rainfall, which if dry weather keeps up will be a slight test as to whether it will thrive best in a dry or wet locality here in the Islands.

So far I have watered all the young seedlings and they have done very well. Seeds of this variety are the only ones so far obtained. But it is doing very well when we remember that not even the Kew Gardens nor the gardens in Ceylon, Singapore, etc., have been able to obtain these other two varieties, though they have been seeking to do so for two years. The Peradeneya Gardens of Ceylon have 100 seedlings of *Manihot dichotoma* growing, also the Singapore and Penang Botanic Gardens. The Peradeneya Gardens are constantly asked for seed, which they can not as yet supply, for planting in the dry lands of Ceylon where the *Hevea braziliensis* can not be grown. We must not, however, forget, that the rest of the tropical world always thinks of these varieties as well as the Ceara in connection with a dry region, and it was only because we found trees of the Ceara variety growing and yielding so well in our wettest localities, as in Nahiku and Puna, and so much better than in the dryer localities, in and around Honolulu, that we decided, what subsequent plantings have all tended to confirm, that wetter localities, if not too cold, are better for the Ceara than the dryer ones here in the Hawaiian Islands. Still it would be a wise thing to plant some of these *Manihot dichotoma* in some dry places for experiment.

Dr. Ule says: "If, as is probable, the cultivation of *Hevea braziliensis* will undoubtedly obtain the greatest importance for the production of rubber in luxuriant tropical regions, the future has to look to *Manihot heptaphylla* and *Manihot piauhyensis* as the rubber plants for the dry and less fertile areas." Of course it is only fair to say that other observers speak as highly of *Manihot dichotoma,* which he has left out in this statement.

To sum up then, there are several reasons why the planters of Hawaii should direct their attention to these varieties.

1. In the first place, the industry in these Islands is in its infancy and we should endeavor to test all the different varieties of rubber-yielding trees which seem to promise well, for we do not yet know which species will prove the best in the long run, all things considered, such as early yield, cheapness of installation, length of yield with constant tapping, amount of yield, cheapness of collection, quality of the rubber obtained, etc., a balancing of all of which will give us finally the best species to cultivate most largely. The present plantations must

necessarily do a great deal of pioneer work in this line, if we consider the industry for the Islands as a whole. After the present companies have shown what can or can not be done commercially with the different species, no doubt many plantations will follow this lead.

2. These varieties in their habitat yield considerably larger quantities than the Ceara and yet thrive under very similar conditions to those in which the Ceara thrives, the variety which so far has proved to grow best here.

3. Most important of all here, are the varieties which promise the lowest cost of collection which, quality being equal, is, as I have said, the pivotal point in regard to the whole industry in Hawaii.

EXPERIMENTS IN TAPPING CEARA RUBBER TREES.[1]

The rubber experiments which are being carried on by the United States experiment station and territorial board of agriculture and forestry have been under way long enough to indicate certain results which are of practical importance to rubber growers. Thus far more than 200 trees, most of them less than three years old, have been tapped. These trees averaged from 12 to 13 inches in circumference and were located chiefly on the grounds of the Koolau Rubber Company, on Maui. In tapping young trees it was not expected that profitable returns of rubber would be obtained; but the plan involved the practical point of determining the rapidity with which trees could be tapped, and satisfactory methods of handling labor to the best advantage. In the first series of 80 trees, which were tapped by means of one vertical cut each day, it required thirty-six hours and forty minutes of labor to tap the trees, collect the latex, and secure 1½ pounds of dry rubber. In the second series of experiments on 160 trees, which were tapped with two vertical cuts instead of one, it required only forty hours of labor to tap the trees, collect the latex, and obtain 5 pounds of first-class rubber and about a pound of scrap rubber. In this experiments in which two vertical cuts were used daily, profitable returns were obtained.

It was found that an ordinary laborer could tap rubber trees by means of two long, vertical cuts at the rate of about 50 trees an hour and could collect latex at the rate of 100 trees an hour.

The available labor on plantations appears to be reasonably effective in doing this work, and the amount of training required in order to make the cuts effectively and quickly is not excessive.

It requires less time to tap older trees than young trees upon which our work is done, and there is also less danger of injuring the trees. We have found that a good flow of latex can be obtained from tapping done between daylight and 8 a. m., or even later.

From the experiments which we have thus far conducted it appears that one man can tap about 50 trees per hour, while another man can collect the latex from the trees which would be tapped in the same time by two men. Since it appears from results which we have obtained from

[1] An address by Dr. E. V. Wilcox, director of the Hawaii experiment station, at the second annual meeting of the Hawaiian Rubber Growers' Association, November, 1908. Reprinted from *The Hawaiian Forester and Agriculturist*, December, 1908.

tapping mature Ceara rubber trees, that about one-third ounce of dry rubber may be expected as a daily yield, it is evident that three men should be able to obtain rubber from mature trees at the rate of about one pound per hour. The data upon which this conclusion is based have been carefully considered and the estimate is probably not above what may be expected. At any rate, the results obtained in our experiments indicate clearly that the Ceara rubber tree in Hawaii will not only grow and thrive, but will yield profitable returns.

Further experiments will be carried on in the microscopic examination of sections of the Ceara rubber tree to get a basis for determining the best method of tapping. Several other species of rubber trees will also be tapped and an elaborate series of fertilizer experiments with rubber is planned. We hope to be able to devise a method of fertilizing rubber trees so as to secure an increased flow of latex during the tapping periods.

International trade in india rubber, 1902–6.[a]

EXPORTS.

Country.	Year beginning.	1902.	1903.	1904.	1905.	1906.
		Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Angola	Jan. 1	2,564,948	6,137,046	5,617,377	[b]5,200,000	[b]5,200,000
Belgium	do	13,016,353	14,088,566	16,335,876	14,997,420	16,940,908
Bolivia	do	4,195,380	2,912,381	4,915,638	3,728,726	[c]3,728,726
Brazil	do	63,122,428	69,923,121	70,251,499	78,027,329	77,073,991
Dutch East Indies	do	426,848	1,475,551	3,590,489	4,569,275	4,564,932
Ecuador	do	870,405	1,090,988	1,145,447	1,293,134	1,394,575
France	do	6,011,956	6,390,101	6,632,627	10,766,377	13,033,578
French Guinea	do	[b]2,426,000	3,280,045	2,952,245	3,121,366	[c]3,121,366
French Kongo	do	1,518,469	1,857,491	2,753,778	3,716,860	[c]3,716,860
Germany[d]	do	13,748,023	11,237,840	10,073,138	18,654,850	12,589,053
Gold Coast Colony	do	1,599,974	2,258,981	4,013,837	3,687,778	3,649,668
Ivory Coast	do	2,011,471	2,572,379	3,386,399	2,602,638	[c]2,602,638
Kamerun	do	935,441	1,822,144	1,920,354	2,141,777	2,537,540
Kongo Free State	do	11,795,724	[b]13,350,000	[b]10,040,000	10,718,358	10,690,060
Netherlands	do	3,544,851	3,231,008	3,998,671	5,760,814	5,605,388
Peru	do	3,749,760	4,648,000	4,896,298	5,598,785	[c]5,598,785
Senegal	do	1,212,262	1,801,957	2,208,623	2,242,786	[c]2,242,786
Singapore	do	920,533	1,441,200	3,026,133	5,053,067	[c]5,053,067
Southern Nigeria Protectorate.	do	865,834	1,177,803	2,408,926	2,842,831	3,434,279
Venezuela	July 1	1,673,308	1,794,626	[e]2,429,461	3,064,296	[c]3,064,296
Other countries	do	4,664,000	5,970,000	8,921,000	13,410,920	21,504,908
Total		140,873,968	158,461,228	171,517,816	201,199,887	207,347,404

IMPORTS.

Austria-Hungary	Jan. 1	2,640,476	2,789,508	2,935,675	3,021,875	4,203,332
Belgium	do	15,908,530	16,977,346	17,983,033	18,744,212	20,813,089
Canada	July 1	2,858,778	3,213,277	2,810,238	2,490,756	[f]2,963,152
France	Jan. 1	12,061,674	12,708,795	14,611,040	19,693,018	23,053,199
Germany[d]	do	33,132,823	34,362,782	38,375,855	47,627,110	38,849,408
Italy	do	1,556,022	1,470,042	1,474,451	1,690,725	2,586,242
Netherlands	do	4,159,714	4,422,234	5,371,310	6,645,498	8,189,950
Russia	do	10,960,379	14,388,134	13,064,780	12,913,540	[f]16,684,114
United Kingdom	do	14,293,888	16,784,992	22,140,048	29,000,832	31,004,400
United States.	July 1	35,010,571	59,015,551	67,234,256	57,844,345	76,963,838
Other countries		3,026,000	3,926,000	8,091,000	9,256,056	[f]9,161,152
Total		155,608,855	170,058,661	194,091,686	208,927,967	234,471,876

[a] General note.
[b] Estimated.
[c] Year preceding.
[d] Not including free ports prior to March 1, 1906.
[e] Average, 1903 and 1905.
[f] Preliminary.

The above table, taken from the Yearbook of the United States Department of Agriculture, showing the movements of rubber, is interesting, first in regard to the production of rubber and second in regard to the countries using rubber for manufacturing.

It will be noticed that Brazil produces the greatest quantity of rubber, but that the production has not increased, in uniform ratio during the years given in the table. This is also true of the other countries which export rubber in large quantities. While the general increase as shown in the totals is comparatively steady, the various countries differ considerably. A decided increase in the exports of rubber in 1903 over those of 1902 will be seen in most of the countries mentioned individually. By subtracting the exports of "other countries" for these years we find that while in 1902 the exports were 136,209,968 pounds, in 1903 they were 152,491,228 pounds. This ratio of increase is not sustained in the years 1905 and 1906, for we find that exclusive of other countries the exports in 1905 were 187,788,467 pounds and in 1906, 186,842,496 pounds. The exports from countries other than those recognized as rubber-producing have been growing rapidly, probably due to the constantly growing area cultivated for raising rubber and more modern methods of tapping. The old methods are well known to be extremely destructive, though they are still in very general use in countries where rubber is grown abundantly.

The table of imports is interesting as showing the great markets for rubber. It will be seen that the United States is far in the lead as an importer, with Germany, Belgium, the United Kingdom, France, and Russia following in order. The amount of imports increases with comparative steadiness in most cases, though Germany, in 1906, and the United States in 1905 make great drops. After 1903 other countries make no very noticeable strides, which would indicate that the manufacture of rubber products is being largely centered in certain countries. Belgium both exports and imports in very even proportion, as do also Germany, France, and the Netherlands, though Germany's imports exceed her exports. Brazil ranks easily as the greatest rubber-producing country and the United States as the greatest consumer, or more properly, the greatest rubber-manufacturing country.

THE CULTIVATION OF THEOBROMA CACAO OR COCOA.[1]

By A. FAUCHÉRE, *Assistant Inspector of Agriculture in Madagascar.*

Native habitation.—Theobroma cacao is an American plant. It was cultivated by the Indians along before the discovery of the New World, therefore it is difficult to determine exactly its native habitation.

It is certain, however, that the cacao tree grows wild in the basins of the Amazon and the Orinoco. But while several authors describe it as growing spontaneously in Mexico and throughout Central America, it is impossible to affirm that it grows in a truly wild state in these regions. It is probable that it has been naturalized by culture. This is the opinion of De Candole as given in "The Origin of Cultivated Plants."

It is claimed that it also grows in a wild state in the forests of Trinidad, where there are cacao trees which produce very small fruit inclosing beans that are nearly white.

Other species of the genus, *Theobroma pentagonum, Theobroma bicolor,* etc., which also furnish edible products, and are cultivated, appear to grow wild even more widely. They are found in the forests of Colombia and Central America.

These points are of secondary importance in a study which must remain essentially practical. It is sufficient to know that the theobroma furnishing the cacao of commerce grows wild in very warm and humid regions.

History.—Before the discovery of America the cacao was of course unknown in Europe. The companions of Ferdinand Cortez who landed in Mexico in 1519 were the first Europeans to use cacao. It was already in use by the natives.

It was toward the end of the sixteenth century that the cacao beans were first brought to Spain. From Spain the use of cacao spread to France, where the first chocolate seems to have been sold about 1650 by a man named Chalion, who received in this matter the special permission of the king. Later the product, at first very expensive, and much appreciated by the higher classes, became cheaper and cheaper, until now it is a delicacy within the reach of nearly all purses.

[1] Extracts from a series of articles entitled "Culture pratique du cacaoyer" published in *L'Agriculture Pratique des Pays Chauds*, beginning in April, 1905.

The consumption increasing constantly, the area of cultivation of the cacao tree is growing more and more. This precious vegetable species is known and cultivated throughout the torrid zone in both hemispheres. However, the true center of culture for the cacao tree remains to the present time confined rather closely to those regions where the plant grew originally.

Although *Theobroma cacao* is cultivated a little everywhere in the East Indies, the west coast of Africa, and in Madagascar, the larger countries that produce cacao are South America, Central America, the Antilles, Equador, Venezuela, Trinidad, the Guianas, Brazil, and Mexico.

It is evident that many of the French colonies have a climate essentially adapted to the culture of cacao. Dahomey, the Ivory Coast, the Congo, perhaps some parts of the Senegal and the Soudan, the middle part of the east coast of Madagascar, Guiana, and the Antilles; all of these would certainly be suitable.

The culture of the cacao tree merits even more attention because it requires so little labor, and furnishes one of the rare colonial commodities whose period of overproduction appears to be far distant.

Species and varieties.—The genus Theobroma belongs to the family of the *Sterculiaceae,* division of the *Buettneriacee.* The most widely dispersed and most commonly cultivated species is the *Theobroma cacao.*

In the wild state *Theobroma cacao* is a small tree, from 7 to 8 meters high. It is generally a little shorter under cultivation, but if planted closely it reaches this height even then.

The trunk is very straight, and ordinarily terminates, when the tree is young, in a verticil of three, four, five, or six branches. Below this crown grow a large number of offshoots, much tangled, which give the young tree a very branchy and tufted appearance.

The leaves are simple, alternate, obvate, oblong, accuminated; the edge even and smooth, except upon the lower side of the veins, where it is hairy. When young the leaves are clear red or a very clear green, according to the variety; when mature they are a very fresh green on the upper side but a little less bright underneath. The dimensions of the cacao leaves vary according to the age and vigor of the tree. A plant which grows normally has leaves 25 to 30 centimeters long and 11 to 12 centimeters wide; but it is not unusual to see leaves larger than this upon young and vigorous specimens. The flowers, which appear almost throughout the year, are arranged in dichotomous cymes, and supported upon slender peduncles, usually uniflorous, and from 2 to 3 centimeters long. The flowers grow upon the old branches and the trunk, sometimes in large numbers.

The five sepals are valvular and colored, ciliated upon the edges. The five petals, alternating with the sepals are likewise colored; they have at the base an enlarged spoon-like portion, surmounted by a short part with a spatulate extremity curved toward the exterior.

The androcephalum is composed of five fertile stamens and five sterile stamens in the form of small linear tongues, which alternate with the fertile stamens. The stamens opposite the petals are terminated by a pair of another with two cells opening outward. The upper ovary, pentagonal, consists of five cells, in each of which there are at least a dozen anatropous ovules arranged in two longitudinal rows. The ovary, covered with glandular hairs, is surmounted by a style with five stigmas.

The fruit, ordinarily known as the cacao pod or capsula, is a berry with an unyielding shell, smooth or rough, of varying form and color. The pod, which is pendant, gives the trunk of the cacao a very curious appearance. Fruit and flowers may be found on the cacao-tree nearly the whole year.

When the shell of the fruit is broken, one finds in the interior the kernels, usually spoken of as beans or seeds, buried in a pink or whitish pulp, of an agreeable and slightly acid taste. The beans are composed of an embryo with wrinkled cotyledons, folded, and here are found the elements for which the cacao is cultivated. The shape of the beans varies; sometimes they are decidedly oval and very much bulged as in Madagascar cacao; again they are much flattened, and almost triangular as in Trinidad cacao. Their size also varies greatly. The beans of the Madagascar cacao are scarcely 1.5 to 2 centimeters long, while the length of those of Surinam is 2.5 centimeters and over. The envelope which surrounds the embryo is red. The color of the bean varies from almost pure white in Madagascar cacao to deep violet in the cacao of Surinam and Trinidad.

Varieties.—Cultivated from remote antiquity, *Theobroma cacao* has not failed, like all plants, to change and develop a considerable number of forms, which may almost be elevated to the rank of varieties. It is not possible, unfortunately, to credit man's will with the variations of the cacao tree; all the varieties, or to be more exact, all of the forms which now exist are nothing more than the result of chance. It is not to be doubted, however, with the tendency of the cacao tree to vary, that a consistent and intelligent selection would result in the production of varieties more profitable under cultivation than those of the present time. It would be particularly interesting to be able to develop forms that would arrive at an earlier maturity. This is the task of the Colonial experiment gardens, but it is a lengthy enterprise, demanding patience, years, and money.

In spite of all, an attempt has been made to classify the known varieties of the cacao tree. The results obtained in this arrangement have more theoretical than practical value, and doubtless each country has its special varieties. Often a form that yields mediocre products in one country, much resembles another which elsewhere furnishes a product of the finest quality.

In Trinidad the varieties of cacao are very numerous; but while the old Spanish planters arranged them in a certain number of divisions, it is very difficult to determine where one variety ends and another begins, the limits which separate them being so indefinite. The classifications of Messrs. Morris and Hart are believed to be far from having a practical value.

In the course of numerous visits among the plantations of Trinidad many of the planters were asked the names of the varieties of cacao they were cultivating; they gave very different responses to this question, two planters rarely giving the same name to an identical variety.

One variety is very well known to all the planters—that called "Calabacillo." It yields a very small fruit, which incloses flattened and serrated beans. It is a subordinate variety yet widely cultivated.

It is difficult to give an exact idea of the variety which in Trinidad is called "Criollo." No planter could point it out to me with any certainty. Hart gives to the term "Criollo" the French meaning of the words indigenous and native; indicating the same relation as when we speak of the half-breeds and blacks of Bourbon as creoles. He seems to believe that the true Criollo is a form which grows wild in the forests of Trinidad. According to him, the Criollo is a cacao tree with an elongated, pointed, slightly reddish fruit, red or yellow, with a pronounced stricture near the peduncle.

In Surinam the planters designate, under the name "Caracas cacao," all the cacaos with red fruits. But nearly all of the specimens which were shown to me for the true Caracas, a widely cultivated variety, possessed absolutely the characteristics of the Criollo described by Hart. This variety produces beautiful roundish beans, whose embryos have a violet tinge. It is the best form that exists in Guiana, and is much in demand among the planters.

The name "Forastero" in Trinidad serves to designate a number of forms inferior in quality to Criollo. The beans of these forms are rather flat, and the cup of the embryo is a deep violet.

It must be admitted that environment suffices to change the characteristics and the quality of the natural form of the cacao. Dr. Preuss offers upon this subject some valuable observations. He says in his book "The Cacao," that the Trinidad cacao introduced into Venezuela improves, and furnishes products that are superior to those which it gives in the English Colony. According to him the Guayaquil cacao, the most widely known, springs from a tree whose beans remind one of the *Amelonado* of Trinidad. The *Amelonado* is a very subordinate form in the English island.

The cacao called Surinam or "Porcelain" corresponds to the *Amelonado* of Trinidad, and is highly valued. Its fruit ripens yellow, is short, almost smooth, a little constricted at the base, and terminates in a very blunt point. It has ten longitudinal grooves more or less deep.

The Alligator cacao, *Theobroma cacao* of Guiana and *Theobroma pentagonum* of Nicaragua, is a less desirable form ripening to yellow. The shell of the fruit is very thick and wrinkled, and the beans are large but flat. The fruit is large and much elongated. Only the true Caracas produces beans whose embryo is a clear color; the other varieties have grains of deep violet color.

The varieties or forms descending from *Theobroma cacao* are far from being exactly classified. It is very difficult with our present amount of knowledge to name with certainty the kind which yields the best quality of cacao, the varieties cultivated, and the environment required for their growth. It is certain that each country possesses varieties with different qualities, and those which furnish the best products are usually the most highly cultivated.

Theobroma cacao is not the only species of the whole genus that may be cultivated to produce the cacao of commerce. In Central America there is cultivated under the name "Alligator" or "Largato," *Theobroma pentagonum,* which furnishes a product of very good cacao. This species differs little from *Theobroma cacao* except in the shape of the fruit. The fruit, instead of having grooves has five strongly marked ridges, between which there are large warts of characteristic form. The beans are large and the embryo pure white.

Theobroma augustifolium is cultivated in Mexico and Central America.

Theobroma bicolor is a large and vigorous variety, whose seeds are not exported. It is found all over Central America. Its fruit has a woody shell, and its leaves are heart-shaped. The white seeds yield a product of no commercial value, but they are much valued in America. *Theobroma bicolor* grows to a height of 12 meters and Dr. Preuss states that it is cultivated as a shade tree for *Theobroma cacao* in Nicaragua. The seeds are very poor in Theobromine.

Climate.—The fact that the natural habitation of Theobroma is never very far from the equator indicates sufficiently the climate necessities. They prosper only in very humid countries.

Under cultivation the geographical area has been much extended. The cacao may now be found as far south as the State of Bahia in Brazil, which is 19°, and Réunion, 21° south latitude, and as far north as Cuba, which is 22° north latitude. Outside of these limits the cultivation of the cacao tree is not possible except under very unusual conditions.

As a general rule the temperature necessary to the profitable growth of the cacao varies from 24° to 28°. The lowest possible temperature is 12° to 14° and the lowest temperature of the year varying from 18° to 20°. It can evidently grow and fructify in colder regions. On the Blue Mountains in Jamaica I have seen it growing and bearing beans at an altitude of 1,800 feet; but it is certain that the cacao could not be cultivated with profit in such localities.

A humid climate is absolutely essential. The cacao demands an annual rainfall of at least 1.60 to 1.80 meters, distributed throughout the entire year. An uninterrupted dry period of two or three months is very prejudicial, though this condition is now ameliorated—thanks to irrigation—and in certain districts of Nicaragua where the dry season lasts from November until May the cacao grows and bears fruit.

The necessities of the cacao with regard to humidity, and especially heat, prevent its cultivation in high altitudes. In Venezuela, Colombia, and Ceylon it is planted to an altitude of 800 meters and even a little higher, but in general its area of cultivation does not rise much above 500 meters near the equator, growing lower as the distance from the equator increases, until it is found at 100 to 150 meters at the northern and southern limits.

In fact, one may say that the regions included between the latitudes 18° south and 20° north, which enjoy climate that has little or no dry season, with an annual rainfall of 1.60 to 1.80 meters at least, and a mean temperature of from 23° to 28°, are adapted to the culture of the cacao tree. Outside of these limits it may grow, but it is rarely profitable.

Certain countries included in this zone of cultivation, which have a prolonged dry season, may grow the cacao by means of systems of irrigation which enable the soil to retain a sufficient amount of moisture.

In the following tables is indicated the rainfall of several regions where the cacao is cultivated on a large scale, and I have shown the monthly rainfall as recorded at Tamatave, Madagascar, during the year 1903. If a prolonged drouth is harmful to this industry, too much humidity may also be harmful to the production of fruit by favoring the development of the cryptogams which attack it. For instance, in Dutch Guiana after the excessive rains at the end of 1901 and early in 1902 the plantations were invaded by cryptogamic maladies, which reduced the production one-half in the best kept plantations.

Rainfall in Trinidad.

Month.	1901.	1902.
	Millimeters.	*Millimeters.*
January	86.5	43.0
February	11.4	11.3
March	94.5	59.7
April	7.5	8.8
May	162.6	108.5
June	262.1	200.5
July	253.5	133.8
August	342.5	296.0
September	128.2	97.8
October	113.5	110.5
November	136.8	125.9
December	313.9	213.1
Total	2.013.1	1,308.9

Rainfall in Tamatave.

Month.	1902.	1903.
	Millimeters.	*Millimeters.*
January	213.4	259.2
February	316.5	187.4
March	544.0	632.8
April	51.0	374.5
May	114.0	260.0
June	136.4	278.6
July	316.7	178.8
August	83.2	291.1
September	95.7	238.1
October	149.4	119.6
November	130.9	72.7
December	251.3	162.5
Total	2,402.6	3,055.3

Rainfall in Surinam.

Month.	1899.	1900.	1901.	1902.
	Millimeters.	*Millimeters.*	*Millimeters.*	*Millimeters.*
January	171.6	235.1	76.9	182.4
February	42.1	328.0	106.7	558.3
March	175.5	322.1	25.7	222.3
April	36.3	223.4	271.5	522.4
May	119.0	371.8	316.9	252.4
June	313.4	210.4	234.2	----------
July	144.1	87.3	179.4	----------
August	59.1	129.8	205.2	----------
September	20.5	82.6	101.1	----------
October	46.5	156.2	117.7	----------
November	64.0	134.3	203.0	----------
December	51.4	114.4	220.9	----------
Total	1,243.5	2,395.4	2,059.2	----------

Soil.—The cacao is rather hard to suit in the matter of soil, but nearly all the authors who have written about this plant have somewhat exaggerated its necessities. Upon reading the chapter on soil in a treatise on the culture of cacao, one is often a little dismayed and apt to question whether all the conditions enumerated could be found in several countries put together.

Having seen the industry thrive in the most diverse countries—in Brazil, in the Guianas, in Trinidad, in Guadalupe, and in Jamaica—it may be said that it is not so hard to suit as has been supposed, and that cacao is able, like all plants, to adapt itself somewhat to the environment in which it lives.

As to the physical composition of the soil, the cacao tree accommodates itself to many different kinds. It grows vigorously in the alluvial clay of Dutch Guiana, in the silicious clay of Trinidad, in the volcanic rock of Guadalupe, and it gives a product of the best quality in the alluvial soil of the Venezuelan coast, which is composed partly of earth washed down by streams from the granite and gneiss formations. In these soils resulting from the decomposition of primitive rocks the cacao seems to improve much in quality, and the Venezuelan cacaos are renowned:

those of Ceylon are likewise favorably known, and I am informed from a reliable source that those of Madagascar are considered worthy to be classed with the best.

I have observed that in the very clayey soils of Dutch Guiana the cacao tree completely transforms its radicular system; that while the taproot loses in importance, the small roots multiply considerably, and one is surprised to see the surface of the beautiful cacao plantations of Surinam covered with a veritable network of large running roots. This adaptation is all the more useful since the water table is always very near the surface. The Dutch planters multiply the drainage ditches in their plantations, but these are always necessarily shallow, for the uniformly flat country is so slightly elevated above the level of the rivers that it is necessary to preserve it from inundation at high tide by special and costly dams, in which there are sluices that drain the plantations at low tide.

As regards the chemical composition of the soil also the cacao tree demands less than has been supposed. M. Jumelle in his excellent work upon the cacao tree holds that a soil in order to be suitable for the culture of this plant should contain 1 to 2 per cent of lime and $2\frac{1}{2}$ per cent of phosphoric acid. It is evident that soils well provided with potash and nitrogen which would contain these quantities of lime and phosphoric acid would offer the cacao tree large nutritive supplies, but it would be dangerous to state as a principle that soils less rich are incapable of producing cacao to a profitable extent.

However, it seems that lands which are poor in phosphoric acid and extremely poor in lime are able to produce cacao, since valuable and highly productive cacao plantations exist on the shores of the Ivoloina and the Ivondro.

MM. Muntz and Rousseaux wrote truly concerning their study of the Madagascar lands: "It is impossible to apply the same coefficient of fertility to lands having the same composition but having different climates." And again: "Some lands that are capable of producing abundant harvests in a warm and humid atmosphere would be sterile in a temperate climate."

In order to draw from the analysis of the lands exact indications as to their productivity, a scale of fertility based on a long series of analyses of lands from the same region in full bearing would be a necessary preliminary, in order to decide upon the proper method of mixture.

In a new country, how is one to determine whether or not the soil is suitable for the culture of cacao? We must reply simply that all lands having the required climatic conditions are suited to this culture if they are deep, friable, of high water-holding capacity, and if they support a forest of large and vigorous trees.

All of the planters of Trinidad, Brazil, and Dutch Guiana who have

been questioned on this subject consider this last condition the criterion, and they would not under any circumstances plant cacao upon virgin soil reclaimed merely from scanty growth or underbrush.

The presence of certain plants growing in a wild state may also be a useful indication, but they have only local value. For example, in Trinidad the best cacao lands are found in the regions where the *Oreodoxa* grow vigorously, also a special variety of Indian-shot plant, which is also found in Dutch Guiana.

Marshy lands are not adapted to the culture of cacao, nor are those where there is compact rock a little below the surface, for here the tree dies when its taproot encounters the rock. But it is, however, possible to establish a cacao plantation in rocky soil, as is often done in Trinidad.

Valleys, even when they are subject to inundations, may be planted with cacao upon condition always that the water is not allowed to remain after the inundations.

It may also be planted upon hills, even when they are very steep, but then a soil of a certain consistency is required, for if it is too mellow erosion is to be feared.

It goes without saying that in countries where the industry is established the new planter should study the conditions that have made the established plantations successful, and profit by the experiences of his predecessors.

It is strongly recomended that, before planting, numerous borings be made in the land chosen, so as not to utilize patches in which there is a bed of sand at a slight depth. In the cacao plantations visited in Madagascar, it was ascertained that the trees planted in lands that appeared to be very good upon the surface, but having a bed of sand at a slight depth, die at about six or eight years of age. The lowest parts of the valleys in Madagascar where the water stays and where the *pandanus* and the *raphia* are found, are not at all suited for cacao. The soil conditions of the cacao plantations of Brazil, in the state of Bahia, are more like those one finds in Madagascar upon the hills where the forests still exist. Soils of brick-red clay, like those of Madagascar and Brazil, lose their agricultural value shortly after the disappearance of the forest.

Clearing.—The ground being chosen, it must then be prepared and divided up. If it is covered with forests, the large trees must be felled and the larger brush cut sometime before the dry season. After this has been done and the brush is sufficiently dry, it may be burned off.

Many of the planters, more in Dutch Guiana than in Trinidad, who have been consulted on this subject were of the opinion that it would be preferable, after cutting down the forest to allow it to grow again for a number of months, and then cut all the young sprouts. Burning has the decided drawback of destroying a great quantity of organic matter, since when it is somewhat dry the humus which covers the soil in forests burns

readily. On the other hand, a large part of the ashes resulting from the burning of the trees and brush is lost for the planter, for if the land slopes a little the tiny streams will wash the ashes down to lower levels, dissolve the mineral substances they contain, and carry them to the sea. Burning, however, has the advantage of destroying a great number of insects and leaving the soil cleaner. It is also true that burning is more economical and it is the usual method of clearing.

When a forest is destroyed in order to establish a cacao plantation, there is the question of reserving near the clearing a certain number of trees to furnish shelter from the sun. The planters about Bahia do this explaining that manual laborers are scarce and they have no better shade for that region. In dutch Guiana and Trinidad the cacao planters destroy ruthlessly all the trees of a forest. They prefer to plant anew, holding it necessary that the protecting trees and the young cacaos develop together in order that the former may not harm the latter by monopolizing the soil. It is true that when the trees of the original forest are reserved for protectors their roots have a strong system already formed, and they rapidly appropriate the nourishment that is needed by the young cacao plants.

The planters of Trinidad and Surinam say that the forest trees are usually slender and have scanty tops, and consequently provide but little shade unless they are planted very near one another; and, too, the exhaustion of the soil by means of their roots is a very serious detriment to the young cacao plantation. Also when forest trees are suddenly deprived of those about them they can not offer much resistance to the wind and are easily uprooted. Naturally the harm done to the young cacaos when a tree falls among them is much greater than the expense incurred in cutting the tree down in the beginning and planting a new protector when the cacaos are first set out.

When one considers the difficulty, not to say impossibility, of saving the forest trees in regular rows and the consequent loss of regularity in the plantation, one agrees readily with the English and Dutch planters that it is much better to cut out the forest trees entirely when the clearing is done, but that sometimes it is necessary to do the other because of the scarcity of laborers or because it is hard to decide upon the kind of shade tree that would be suitable in that particular region. When the forest trees are to be saved it is necessary to clear a spare about them so that they may not be burned.

Drainage.—If the sight chosen is flat and rests upon a subsoil that is ever so slightly clayey it must be thoroughly drained by means of ditches, more or less deep and closely placed, according to the nature of the soil. In the alluvial clays of Dutch Guiana the planters have been obliged to divide their ground into strips from 7 to 8 meters wide, separated by ditches that are as much as 60 centimeters wide and not

quite so deep. These ditches empty into larger ditches, which in their turn open into the general canal that surrounds the plantation and connects with the rivers.

Where the plantation is hilly it is usually not practicable to dig ditches, but if the land slopes very much it may be necessary to make small trenches that slope gently, carrying the water off but without washing down the soil.

Shelters against the wind.—When a plantation is situated in a location that is exposed to strong winds, it is absolutely essential that every 100 meters at right angles to the direction of the prevailing winds, there should be a strip of ground at least 10 meters wide, upon which there is planted a strong barrier of trees; to prevent the roots of these trees from exhausting the surrounding land, this strip of land should be isolated from the rest of the plantation by a ditch 50 to 60 centimeters deep and equally wide.

In mountainous countries if the winds are violent, it may be prudent and even necessary to plant only upon the sides that are not exposed to the wind. If one plants upon exposed portions the shelters will have to be placed closer together, for their protection will not extend so far as it does on level ground. Of course when one plants on forest land it is wise to save these shelters at the time of cutting out the trees, and to protect them carefully while burning off the brush.

Digging up.—A thorough digging up of the soil is not usually done before planting the cacao. It would doubtless be very advantageous to have the soil well dug, as is done in Europe in the cultivation of shrubs, but unfortunately planters are limited to inefficient land labor, and are unable to give the soil the sort of culture considered indispensable in temperate climates; and they are obliged to merely work up the ground where each tree is planted. Where the soil is light and devoid of stones, even the digging of holes may be dispensed with, but since this operation is so beneficial to the young plants it should not be neglected.

Staking.—When the land has been cleared, roads planned, and the location of the wind-breaks decided upon, the planter proceeds to the staking. Staking consists in marking, with a strong stake, the exact place of each cacao tree. In Trinidad this work is usually done "by the piece," by men who are paid 4 frances for every 100 stakes planted. The making of the stakes is at their expense, though the wood used is supposed to be found on the place. When a forest is cleared all the wood that may be used for poles, stakes, etc., should be saved before the burning begins.

Alignment.—In Trinidad and Dutch Guiana it is considered very important that the lines of cacao should be very straight, and the plantations laid out with regularity. This really should be done everywhere

and in all kinds of cultivation, for it is infinitely easier to manage plantations that have been laid out carefully. In these two countries all the work of keeping the plantations in repair is done "by the job," and it is indispensable that they be regular. In the matter of weeding, for instance, the price is based on the surface covered by a given number of trees. Regularity in a plantation has the further advantage of giving all the trees the same amount of space, and allowing each one an equal chance to develop.

Distance.—The distance at which trees are planted varies necessarily with the richness of the soil, but ordinarily they are planted much too close. In Surinam, in the old plantations, the trees are 14 feet apart, but the planters have concluded that this distance is not sufficient and they now plant at 16 and 18 feet.

If it is desired to cultivate the soil intensively, the method adopted by Grenada planters may be followed, and the cacaos placed 3 meters apart without shelter from the sun. The period of full bearing comes more quickly, but the plantation does not last so long and it is necessary, in order to maintain the productivity, to provide dressing for the soil, as well as to burn it, measures not usually necessary in large plantations.

If too close planting has its drawbacks, too great spacing is equally bad, because the trees consume too much time in covering the soil with their shade, the expenses of keeping a plantation in repair are increased also, for when the soil is entirely shaded the undergrowth is scantier, and the expenses of weeding are reduced to a minimum. It must also be considered that in plantations very widely spaced the period of full bearing is attained later, but the returns are greater than in closer spaced plantations.

The manager of the Jagshust plantation, one of the largest and most intelligently conducted in Dutch Guiana, stated last year that it seemed very practical to him to plant the cacaos in rows 3 meters apart and the trees placed from 5.5 to 6 meters apart in the rows, in such a way that the trees on one line alternate in position with those on the adjacent lines. This method of procedure avoids both extremes and has added value because it comes from a person who is very well posted on all that concerns the practical culture of cacao.

Shelter from the sun.—The staking being completed, the shade trees are to be planted. Of course the wind-breaks should be planted as far in advance as possible, but it is well not to plant the shade trees too long before the cacaos to avoid the afore-mentioned difficulty of having the shade trees so well developed that they monopolize the soil before the cacaos are planted.

All of the planters consulted on the subject agreed that it is bad to plant under too dense a shade. The young trees remain puny and weak,

while if they are exposed somewhat to the sun during the first few years they are much stronger.

Character of the wind-breaks.—The wind-breaks are, as we have said, belts of trees planted certain distances apart, at right angles to the prevailing winds, to protect the plantations from their ravages.

The wind-break should be a veritable curtain which should be formed:

First, of a row of large trees planted in the center.

Second, of rows of small trees or shrubs which will fill in around the bare trunks and lower branches of the larger trees.

One should proceed thus: Plant in the center of the strip of land, upon two lines 2 meters apart, the large trees 4 meters apart on the line. On each side there should remain a space 4 meters wide, in which plant two or three rows of little trees or shrubs.

The essential requirements in choosing trees for wind-breaks are that they should grow rapidly and be flexible enough not to break in a strong wind. A large number of species meet these requirements more or less perfectly. These varieties are, for the large trees: *Artocarpus incisa* and *integrifolia, Swietenia mahagoni* and *macrophylla, Cedrela odorata, Hura crepitans,* several *Ficus, Eucalyptus robusta* and *citriodora, Grevillea robusta,* etc., *Albizzia stipulata, Inga dulcis, Khaya senegalensis, Melin Azedarack,* etc.[1]

As for the smaller plants, about 2 meters high, which must be bushy from the base, there is only the difficulty of choosing among a great number. The *Acalypha,* which grows very rapidly, attains a height of 5 or 6 meters, and grows easily from slips, all of which qualities render it very suitable for this purpose. As we said above, it will be well to establish the wind-breaks as long as possible before setting out the plantation, but if this can not be very long it would be prudent to plant, in places that are least protected, temporary shelters of banana trees.

Planting of trees for shade.—Nearly all planters admit that shade is absolutely indispensable to the cacao tree. Examination of the localities in which the cacao grows naturally supports this view, but nevertheless while it is recognized that shade is indispensable when the tree is young, I can not say that the same is true after a certain age is reached. The various methods of cultivation that are used prevent the making of a definite statement in this regard, for while certain planters like those of Trinidad are of the opinion that compact shade is absolutely necessary, others believe that this is not so. In Dutch Guiana it is agreed that in the past the plantations have been too much shaded, so where the

[1] The *Artocarpus incisa* and *integrifolia, Swietenia mahagoni* and *macrophylla, Ficus* and *Eucalyptus* grow in the Philippines. The Madre-cacao, *cacuarina equisetafolia, Tamarindue indices,* and *Acacia melanoxylon,* native trees, are also recommended.

shade trees were formerly spaced at 30 feet, in the new plantations they are 60 and 66 feet apart; and in one of the districts of Dutch Guiana there is a 200-acre plantation with no shade trees whatever, which yields very satisfactory results. In Grenada, situated very near to Trinidad, the cacaos are not shaded at all. I should not conclude that those who shade the cacaos are wrong, and those who do not shade them are right, or vice versa. In agriculture it is necessary to be very prudent before condemning this or that method of cultivation, for it is usually based on practical observations, confirmed by many years of experience. I will say on the contrary, that it seems to me that the Trinidad planters who shade their cacaos excessively are right, and that those of Grenada, who do not shade them, are equally right, since both succeed in making money.

It is necessary, I think, to search out the cause of the differences in these methods of cultivation, and Dr. Preuss believes that it lies in climatic differences, also possibly in different soil conditions. While in Trinidad the annual rainfall rarely exeeeds 1.8 meters, in Grenada it is almost never less than 3 meters. The planters of Trinidad have often remarked that in dry years the plantations insufficiently shaded are destroyed, and on the contrary, those in which the shade trees were well-developed resisted the drought sucessfully. In Trinidad one shade tree is planted for two cacaos. This gives much shade. But in Nicaragua, where the dry season lasts a long time, frequently a shade tree is planted for each cacao.

In short, observation of existing facts leads to the general conclusion that intensity of foliage, all other things being equal, varies inversely as the degree of the humidity of the climate; and under certain circumstances the shade trees may even be entirely dispensed with. Cacaos raised under these conditions are not so well developed, bear fruit much sooner, and wear out more rapidly.

The climate of the east coast of Madagascar, if one considers only the amount of rain, is on the whole very humid, since the annual rainfall is often as much as three meters. It must be considered that the climate in general, probably on account of the complete absence of forests, on the greater part of the shore is decidedly different from that of other more heavily wooded regions, Trinidad for example, where the rainfall is much less.

In forest regions few days pass in which there are not drizzling rains, which, it is true, leave slight traces in the rain gauge, but are sufficient to maintain the freshness and considerably diminish the evaporation. Upon the east coast of Madagascar, on the contrary, in the height of the rainy season, there are many successive days without even slight precipitation. These dry periods, which almost immediately follow the very rainy periods, are generally accompanied by continued sunshine

and dry winds and before long the plants suffer from too much evaporation.

These observations lead me to believe, though other persons are of the opposite opinion, that the cacao has absolute need of fairly intense shade, at least in the region about Tamatave.

Other statements in this connection suggest that the failures which have accompanied certain attempts at cultivation of the cacao upon the east coast are partly due to insufficient shade and shelter against the wind.

Temporary shelters.—The temporary shelters must, of course, grow rapidly to adequately shade the young plantation. The banana is usually chosen, but the planters of Trinidad, Venezuela, and Guiana ordinarily add at first, to augment the shade, certain other species such as cassava, which they plant very close to the young cacao.

In many places one banana is planted for each cacao, in Trinidad two are planted. In Surinam I have seen young cacao plantations in which the trees were planted 16 feet apart, while the distance between the bananas is 10 feet. This makes the plantation irregular, which I do not recommend, and I much prefer the method employed in Trinidad. The stakes marking the places of the cacaos having been planted in squares, 4 or 4.5 meters apart, the places of the bananas are next marked with smaller pickets. The cacaos are planted upon the lines, and in each direction a banana is placed halfway between one cacao and the next. Thus there are two bananas for each cacao. This arrangement I consider preferable to that in which the cacaos are planted between continuous lines of bananas, for these lines soon form a sort of canopy and so place the cacaos in a passage that deprives them of light and subjects them to a continual current of air. One may, of course, plant in squares, or quincunx (the trees in one row opposite the spaces in the next row). In the latter arrangement the trees are more evenly spaced.

In Jamaica the cacao is often planted in banana plantations, whose fruit is shipped to the United States.

In Dutch Guiana, as generally in Trinidad, this or that species of banana is not employed indifferently, but the preference is given to the *Musa paradisiaca,* which the Dutch call "Bakoven" and the English "Plantin." In Trinidad the variety of banana chiefly cultivated is the "Gross-Michel," which must also be a variety of *Musa paradisiaca.*

The forms of *Musa sapientum* give less shade, develop less, and ordinarily finish by fruiting in the third year.

Among the varieties of the banana studied at the Ivoloina experiment station to determine their value as shade plants in the cacao plantations, one, the "Banana figue," known to the natives as "Ankondromvazaha" (banana in English), has suffered so much from the attacks of a

weevil, recognized by M. Fleutiaux, entomologist of the Colonial garden, as *Sphenophorus sordidus,* that it has been completed destroyed, leaving the young cacaos which it was shading exposed to the rays of the sun. This circumstance confirms the statement that in Madagascar as everywhere else the cacao needs a great deal of shade when young. The abaca will, perhaps, be found useful, the fibers of which find ready sale in Europe.

At the same time or a little after the bananas are planted, it is customary to plant three slips of cassava, in triangular position about 60 centimeters from the stake that marks the place for each cacao. These will furnish shade for the young plant in the first days after setting out, or if the seed is planted directly in the ground, when it first sprouts.

Other plants may be used in place of the cassava; but they must be plants that grow quickly and start easily from slips. The "pignon d'Inde," used as a support for vanilla, might be used as a substitute. The mulberry tree is another possible substitute, and the Ambrevade (*Cajanus indica*) or the mimosa of La Réunion (*Leucaena glauca*) might also be employed.

At the Ivoloina experiment station important experiments in connection with shade trees are soon to be commenced. The *Cajanus indica, Lancaena glauca,* and the Murier already in use by a planter in the Ivondro valley, are to be the subjects. The first two varieties, which are leguminous plants, grow rapidly, are very jagged in shape, possess the ability to absorb nitrogen from the air, and are valuable for fodder. They seem to be even better than cassava for shielding the young cacaos. It suffices, apparently, to sow their seeds about three months before the cacao trees are set out, in three or four places around the holes that the young trees are to occupy, in order to secure the proper amount of shade.

In South America and the Antilles the cassava is given the preference because its product is valuable. When it is a question of replacing a plantation of shrubs already established, with cacao, it is often possible to make use of the shrubs already planted, for temporary shelter. Thus in Dutch Guiana I have seen planters use coffee trees to shade the young cacaos that were to replace them in the course of time. When this is done it is necessary to carefully prune and thin the shrubs so that the young plants about them will not suffer.

Permanent shelters.—Permanent shelters are made of various kinds of trees which should theoretically fulfill the following conditions: They should grow rapidly, should have taproots, in order not to exhaust the surface of the soil, should grow high enough so that the cacaos can attain full development beneath their tops, and should have foliage dense enough to afford sufficient but not too much shade.

As a matter of fact it is almost impossible to find a tree that combines all the requisites I have enumerated, though most of the trees employed by the planters in the different countries possess them to a greater or less extent.

The trees most in use for shading cacao plantations are probably those which belong to the genus Erythrina. In Dutch Guiana, Trinidad, and Venezuela they plant almost exclusively *Erythrina umbrosa* and *velutina,* which the old Spanish planters called "Madre del cacao" (mother of cacao), and the Dutch of Surinam "Koffeemama." The *Erythrina umbrosa,* known in Trinidad under the name of "Ananco," is tall, of large dimensions, and reserved for mountainous regions. *Erythrina velutina,* called "Bocare," is especially suited to the plains, and thrives more than *Erythrina umbrosa* in humid ground. This is certainly the "Bocare" found everywhere in Dutch Guiana.

The Dutch, the English of Trinidad, and Venezuelan planters would not consider replacing the Erythrina with any other vegetable species. One would suppose that this tree possessed all the requisite qualities given above, but this is not the case. In the first place the Erythrina have thick trunks, and *Erythrina umbrosa* in plantations often attain a height of more than 25 meters, their trunks being more than a meter thick at the base. Multiplying by means of slips or suckers, these gigantic trees have no taproot. Their radicular system is uniquely formed of enormous roots which run on top of the soil more than 20 meters from the trunk, not always rendering the tree sufficiently stable, especially when it grows on clayey slopes. In the cacao-plantations in the districts of Montserrat and Couva I have more than once seen these giants uprooted by the wind, usually after a heavy rain. The damage done, by their fall, to the cacao trees in the immediate vicinity can easily be imagined. This is not the only drawback possessed by these "immortals." They drop their leaves each year. Some persons regard this as an advantage, but all the planters questioned considered it a disadvantage: and Dr. Preuss, whose judgment is indisputable in matters of colonial cultures, is also of their opinion.

In view of these drawbacks one naturally questions why planters as expert in cacao culture as those of the Guianas, Trinidad, and Venezuela persist in using such a species. It has, in common with all leguminous plants, the ability to assimilate directly, through symbiosis, atmospheric nitrogen, but this fact is not sufficient to explain the preference of the planters.

Recently Professor Carmady, government chemist in Trinidad, in the course of a very interesting study has demonstrated scientifically the reason for the almost exclusive use of the Erythrina in that island for shading the cacao plantations.

Bonane's experiments have shown us that cacao beans are very rich in nitrogen, and he has calculated that 1,000 kilos of cured beans contain 16.4 kilos of nitrogen. Thus, with every ton of cured cacao exported from a plantation the soil loses 10.4 kilos of nitrogen, which can only be replaced by the nitrification of organic material that is already present, unless it is artificially introduced in manure or by some other means.

M. Carmady has demonstrated in a series of analyses that Erythrina have such great power to assimilate nitrogen that the flowers which fall to the ground furnish sufficient nitrogen to make up for that loss through the cacao beans. He has calculated that 250 cacao trees produced 500 pounds of cacao, containing altogether 12.5 pounds of nitrogen. To shade these cacao trees 50 "immortals" are required, which drop about 500 pounds of dry flowers containing 4 per cent of nitrogen—about 20 pounds.

This author has also remarked that the flowers should be turned under the surface as soon as possible after they have fallen, for they rapidly lose a large part of their nitrogen. This fact has been ascertained through analyses made in the laboratory at Port of Spain. The fresh Erythrina flowers contain but 6.32 per cent, of nitrogen. Two days after their fall they contain but 5.16 per cent, and five days after they contain 4.25 per cent.

The quantity 500 pounds, which M. Carmady indicates as the production of 50 trees, will not seem to be an exaggeration to anyone who has seen this species when it is in flower. It very evidently belongs to those arborescent species which flower most abundantly.

The Java planters make use of many species of Erythrina, among them *Erythrina subombrans*. The ability to assimilate nitrogen possessed by this plant species has been demonstrated by M. Grandeau, who has, according to M. Dybowski, given the following analysis of 1,000 kilos of dry leaves:

	Kilos.
Nitrogen	18.79
Phosphoric acid	1.40
Potash	3.18
Lime	37.00
Magnesia	2.50

It is quite evident that the fallen leaves amount to a veritable dressing for the soil.

Beside the desirable qualities pointed out by M. M. Carmady and Grandeau, the Erythrina have the further advantages of growing rapidly and multiplying readily by slips. In three or four years they are high enough to shade the cacaos. However, it is unfortunate that its wood is of no value.

In Nicaragua the *Gliceridium maculata* is used. I have seen this species under experiment at the Sainte-Clair station, in Trinidad, and the director expressed strong hopes of success.

The *Pithcolobium saman,* which is sometimes employed in Venezuela, is not used at all in Trinidad or Dutch Guiana, where it is considered worthless because its development is slow and nothing can grow under its shade. M. Hart, of Trinidad, however, who is a man of very wide experience, recommends the use of this tree.

In the East Indies different species of Albizzia are used, particularly *Albizzia moluccana* and *stipulata,* which grow with extraordinary rapidity, but which are said to offer too little resistance to the winds. *Albizzia lebbeck* is also employed. It grows more slowly, but resists storms more successfuly.

Many other species are considered valuable; among them the *Swietenia mahagoni.* In Guadaloupe the *Cedrela odorata* are preferred to the Erythrina, which are said to be overrun by parasites. This argument does seem convincing to me, for in Dutch Guiana the planters take care, every other year, to clear the "immortals" of the multitudes of epiphytes that cover them. The *Cedrela odorata* and the *Swietenia mahagoni* are trees that attain gigantic dimensions, and give, it is true, after thirty or forty years, wood of good quality, but they have not the ability that leguminous plants possess to assimilate atmospheric nitrogen, and so they exhaust the soil to a considerable extent. For this reason I do not agree with Guerin who values them highly. The cacao plantation sheltered by *Cedrela* and *Khaya senegalensis* which I visited in Guadaloupe are not to be compared with those of Trinidad.

Of the many other species used to shade cacao plantations, *Autocarpus incisa,* different species of Inga, the Anacardium, *Hura crepitans,* and in Ceylon, the *Manihot glaziovii,* none except the Inga, give the best results. They are not employed to any great extent, except those which bear edible fruits, for the planters who possess but little ground plant a mixture of all species that will furnish food products. The *Manihot glaziovii* is utterly useless in Madagascar, where it is easily broken by the cyclones. In Jamaica I have seen a small cacao plantation shaded by coconut palms, but I do not believe that the coconut palm could be regularly cited as a shade tree for cacao plantations.

Some authors have written that the nutmeg tree is used in certain places, but this must have been an error, for the growth of *Myristica fragans* is much too slow, and this plant is supposed to require shelter itself during the first years of its life.

On the whole, in choosing the species for permanent shade trees, it seems best to confine oneself to trees of the leguminous variety, which grow rapidly and least exhaust the soil. Small planters employ all sorts

of varieties mixed together, but I do not consider this advisable. For the Congo, M. Rousselot recommends the *Musanga sclinithi,* much valued by M. Dybowski.

In Madagascar, the plantations established up to the present on the east coast are all shaded with "bois-noir" (*Albizzia lebbeck*), which develops very satisfactorily. It grows slowly, unfortunately, but it resists the wind very well, and is, so far, the only species that has shown good cause for being recommended. The foliage is not too dense, in fact this is the chief drawback, for it is deciduous, and is said to leave the trees it should shade too long exposed to the sun.

Multiplication of this species may be by means of slips, but the seeds are generally used, since the young plants stand transplanting well. The growth is less rapid than that of Erythrina, so it is necessary to plant *Albizzia lebbeck* at least two years before setting out the young cacao trees. In every case I recommended that colonists delay planting the bananas until after the Albizzia have attained a certain height, because if the bananas get the upper hand, they will form too intense a shade and may prevent their growth. The observations made at the Ivoloina station are quite convincing in this matter.

On the east coast of Madagascar there are many species of "immortals" of which we do not know the exact names. It is very probable that they can be utilized as well as the *Erythrina umbrosa* and *velutina.* It is a pity that their foliage does not last long and is attacked at different times of the year by a multitude of caterpillars which may be very dangerous for the cacao plantation. Nevertheless, I believe as did the late M. Lacharme, that it would be interesting to study these species with a view of determining their value as shade trees.

In the Matitanana valley, Province of Farafangana, there are a great number of Erythrina which are well developed and strongly resemble the "Bocare" of Trinidad. The natives call this "Sanganakoholahy" (cock's comb), and are well aware of the favorable influence it exerts in cultivation generally. They are very glad to plant their rice where it has been growing. It is probable that this species might be advantageously employed to shade cacao plantations.

Albizzia lebbeck, though it has valuable qualities, is not altogether suitable because it grows slowly and has deciduous foliage. Since 1898 the Department of Agriculture has been introducing into Madagascar the species most used by the planters of the East Indies. *Albizzia maluccana, Albizzia stipulata,* and *Pithecolobium saman* are now being studied at the Tamatave station. The first two species grow with extraordinary rapidity. Plants set in place in August, 1901, were over 7 meters high in February, 1902.

So far as we can now tell, these two varieties, which seem to resist the wind very well at the Ivoloina experiment station, may be employed on the east coast with very satisfactory results. It suffices, apparently, to plant them several months before the bananas, so that they will not suffer from too intense shade, and if set out at least six or eight months before the young cacaos, they should be ready to shade the plantation when the bananas begin to lose their vigor. They are covered with leaves during the entire year, which is also a desirable characteristic. These experiments are of too recent date to enable us to draw very perfect conclusions. It will be necessary first to see how practical they prove as shade trees on plantations, before stating their exact value, but it appears that they can be tried without any fear of bad results.

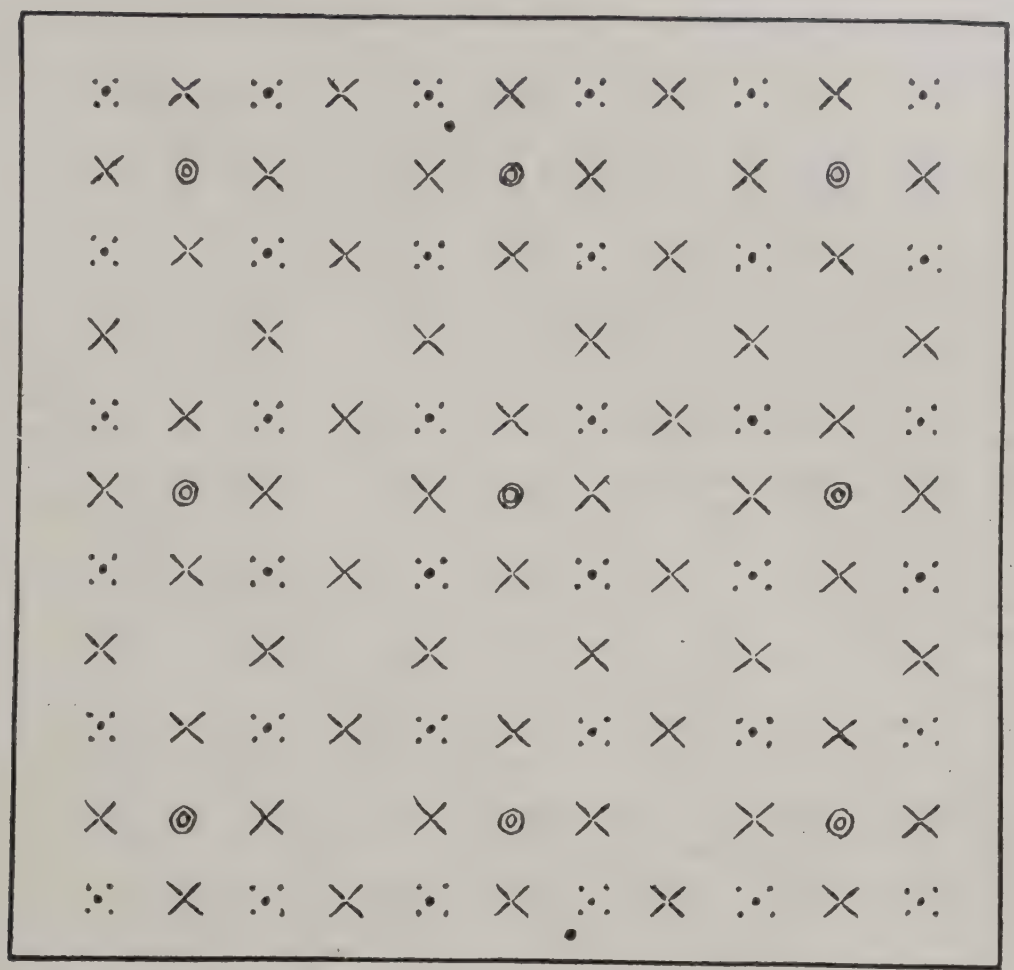
The *Pitchecolobium saman* develops very slowly. Those planted at the same time as the *Albizzia moluccana* and *stipulata* have attained a height of only 2.5 meters. They grow very capriciously, but appear to offer strong resistance to the wind. We shall know in the future the shade value of this plant in Madagascar.

Spacing of shade trees.—The trees intended for permanent shade should, as we have said before, be planted rather widely apart when the plantation is situated in a humid region. In Dutch Guiana the "immortals" were formerly planted 30 feet (10 meters) apart, but now the distance has been increased to 60 and 66 feet (20 to 22 meters). In Trinidad, on the contrary they are much closer, and the distance ordinarily adopted is 28 feet (about 9 meters), or double the distance that separates the cacaos.

In dryer regions, such as Nicaragua, one shade tree is often planted for each cacao. In Madagascar, considering the climate, and the development attained by the "bois noir," and as nearly as we can judge by the *Albizzia moluccana* and *stipulata,* it would seem best to plant 8 or 9 meters apart, according to whether the planting is done in squares or quincunx, in order to assure sufficient shade in the first years after the bananas are taken out. Later it will probably be necessary to take out every second tree, but this elimination must be done gradually, and preceded by judicious prunning.

To avoid possible damage to the cacaos through the felling of large trees, Trinidad planters cut a ring from 50 to 60 centimeters wide around the base of the tree that is to be cut down, and strip off the bark. The tree dries up slowly, decay sets in and the big branches fall one by one.

To conclude the discussion of the arrangement of a plantation, I have made this sketch (see diagram), in which the cacaos are supposed to be planted 4 meters apart, the shade trees 8 meters, and the bananas 4 meters on lines 2 meters apart.



This is the arrangement adopted by the Trinidad planters, who have just claim to the reputation of knowing how to cultivate cacao.

Holing.—As a general rule it is admitted that the holes should be dug as long as possible before the planting. In countries favorable to cacao culture this may be done if the soil is permeable. If it is clayey, as in Dutch Guiana, it is preferable to fill the holes up again after they have been dug, otherwise they will become full of water and it will be necessary to empty this before the plant is set in place. Besides being unnecessary this process would leave the hole in poor condition for the planting.

In Madagascar there is but little inconvenience of this sort to contend with. The alluvial soil is usually quite permeable, and the water that collects in the holes after continued rains soon soaks into the surrounding earth.

The size of the holes varies according to the soil. In regions where the ground is mellow and hand labor scarce, as in Equador for instance,

holes are not usually dug. In Trinidad, however, where the soil is very compact, they are also dispensed with, and at the time the plant with the ball of earth about its roots is set in place, it is sufficient to make a hole a very little larger than this ball, and set the tree in it. It would be better, perhaps, to dig holes, but the results justify the means. Cacao plantations in Trinidad planted in this manner grew well, and that is enough for the planters who obtain profitable results.

Surinam planters usually dig holes because of the compactness of the soil. These excavations measure 3 feet (1 meter) on each side, and are 1½ feet (0.5 of a meter) deep. It might be well to make them a little deeper, for in Surinam, as has been said before, the cacao sends out a large number of horizontal roots which spread out over the surface of the ground, and which do not always give the tree sufficient stability, so that it is often uprooted by the wind. By digging deeper the taproot is enabled to push farther down and thus render the tree more stable. However, the peculiar condition of the soil at Surinam must be considered, for there the water table lies so near the surface that the taproot should not be allowed to penetrate so far as it might in more healthy soils.

On the east coast of Madagascar the holes measure 60 centimeters on each side, which appears to be sufficient. When the holes have been filled up and are emptied again for planting, settling must be allowed for. In replacing the earth a mound at least 8 or 10 centimeters above the level of the ground should be formed, so that after the earth has settled the collar of the tree will be on a level with the mound. Otherwise the cacao is soon surrounded by a sort of basin, in which the water collects after each rain, to the great detriment of the radicular system.

When the plantation is made in a forest clearing, which means that the ground will be covered with a more are less thick bed of humus, it would be a mistake to fill up the holes with pure humus.

This humus is so diluted by the rains and becomes so hot under the rays of the sun that plants so placed can not live, or at least can not thrive. Experiments made in this line in Dutch Guiana by M. Folmer, manager of Jagltust, the most important plantation in Surinam, have been absolutely conclusive, and it has been found necessary in filling up the holes to mix the humus and the earth in more or less equal parts.

In Madagascar the surface of the land suitable for cacao culture is covered with a layer formed of vegetable mold, with which one need not fear to fill the holes. In filling the holes it may be useful, when the soil is not very rich, to put in some ashes and manure. The Dutch planters do this when they plant upon land that has already produced a crop, for example, of sugar cane.

Holes for the shade trees are not usually dug in advance. It is customary to dig them when the trees are ready to be placed, and they are as small as possible.

A STUDY OF THE VARIETIES OF ABACA (MANILA HEMP).[1]

By M. M. Saleeby, B. S.

INTRODUCTION.

In the abacá industry, as well as in the industry of any other fiber plant, five steps present themselves to the progressive planter. They are: (1) The selection of a suitable location; (2) the mode of preparing the soil; (3) the selection of seeds; (4) cultivation; and (5) the extraction of fiber.

Many reliable publications issued by the Bureau of Agriculture safely guide the planter through all the above-mentioned steps, with the exception of the third, regarding which, as far as I have seen, no information of any weight has been offered him. This step is no more an insignificant one, since it has been demonstrated that there are many varieties of abacá differing considerably in the quality and relative quantity of the fiber contained therein, as well as in size and extent of growth. Indeed the difference in the net results amounts to as much as 30 per cent, or even more, as will be shown later on; besides some varieties are of so much hardier growth than others that where they thrive fairly well the others fail altogether.

Such being the magnitude of this step in the abacá industry, it would be an unpardonable shame if the industry were allowed to continue any longer destitute of one of the principal constituents that is essential to its success.

To do justice to this step, then, demands a thorough study of the common varieties under cultivation with the aim of facilitating their identification and finding out which of them possess all or most of the desirable qualities, which may be summed up in rapid and hardy growth, great size, abundant fiber of good quality and easy of extraction. All varieties fulfilling most of the above requisites will be suitable for propagation.

This study is obviously full of difficulties and of a complex nature which I do not profess to have as yet overcome completely or to have arrived at a perfect and ultimate result, but I hope, with the conclusions reached, to be able to give the prospective planter some helpful suggestions that may safely guide him toward success.

[1] Published in *The Mindanao Herald*, volume 6, No. 11, Feb. 3, 1909.

CLASSIFICATION.

In the district of Davao there are nine varieties of abacá under cultivation, namely: (1) Tangouan, (2) Maguindanao, (3) Bangulanun, (4) Libuton, (5) Arupan, (6) Lumawaan, (7) Puteean, (8) Baguisanun, and (9) Agutay. The first six are the principal ones, while the last three are the ones that should be carefully avoided for reasons hereafter given.

The principal differences between these varieties are in the color, the size and shape of the stalk, the tendency to produce suckers, and the quality and quantity of the fiber. The color of the flower cone is not a very safe guide, excepting in the Libuton variety where a marked difference in the color can be easily detected; the way the leaves emanate from the stalk will be referred to occasionally where that helps as a distinguishing characteristic.

1. TANGOUAN.

This variety is undoubtedly the hardiest. It is not a rare sight to see the Tangouan growing to a good size in an indifferent soil with little attention, where other varieties are making a desperate struggle for existence. The difficult processes of tuxy-making and of stripping this variety also show its hardy nature.

Color of stalk.—The color of the Tangouan stalk is both light and deep purple with hardly any green lines running up and down as in the other varieties. Often the color on the outward side of the stalk is deeper, almost approaching black. In other words, the dark and glossy aspect of the Tangouan hill is peculiar, and no other variety can be mistaken for it.

Size of stalk.—The stalks may grow to a great height and size, especially in what the natives call the "Male Tangouan." On many occasions I have handled stalks measuring 20 feet in height and weighing 200 to 220 pounds, while in one instance I stripped 6 pounds of dry fiber from one stalk with the ordinary method of stripping.

Shape of stalk.—The stalk tapers as in most other varieties; the ratio between the circumference at the top and that at the base being as $2\frac{1}{3}$ to 1.

Tendency to produce suckers.—The male variety that has been mentioned before as bearing large stalks does not produce as many suckers as the female variety, the stalks of which do not come to any considerable height or size. In other respects the two behave exactly the same.

Quality of fiber.—The fiber is coarser and stronger but not quite so white as that of the others. That it is the strongest fiber, I have no doubt; but as to its coarseness and brownness, it may be all or partly owing to imperfect stripping; to strip this variety for any considerable length of time is a trying task that most strippers are averse to tackling.

PLATE II. NATIVE METHOD OF STRIPPING MANILA HEMP.

Quantity of fiber.—Every 100 pounds of stalk material contain from $2\frac{1}{2}$ to $2\frac{3}{4}$ pounds of dry fiber.

2. MAGUINDANAO.

This is the favorite variety of a large number of planters, because of the good quality of its fiber and the facility of extracting it. It is also reckoned among the hardy varieties, though it falls short of Tangouan in this respect.

The way the leaves hang on the step is different from any other variety. After reaching a certain height, or as soon as they come out of the stalk, they bend down and take the shape of a bow.

Color of stalk.—More or less green with light purple and brown colors running through it.

Size of stalk.—Generally speaking it grows to a greater size than Tangouan, especially at the base, but it does not grow so high.

Shape of stalk.—Even a little more tapering than Tangouan, the ratio between the two circumferences being as $2\frac{1}{3}$ to 1.

Tendency to produce suckers.—As a rule it produces more stalks to the hill than Tangouan, 15 to 20 being about an average.

Quality of fiber.—White, strong and easy of extraction.

Quantity of fiber.—About $1\frac{3}{4}$ pounds to every 100 pounds of stalk material.

3. BANGULANUN.

Lately this variety has been gaining favor with many planters and is preferred by them to both Tangouan and Maguindanao. We have not this variety on our place, and unfortunately I have not had time to study it carefully, but from the reports about it, it seems to possess all of the requisites of an abacá plant, with the exception of the size of the stalks which do not grow to any considerable height or size. It has a good number of stalks to the hill, and a white and abundant fiber.

4. LIBUTON.

Color of stalk.—It is a mixture of deep green and brown, the light purple colors of the first two being absent here.

Shape of stalk.—Just like Tangouan.

Size of stalk.—The stalks do not grow to the size of Maguindanao or Tangouan, while a height of 15 feet is about all they can reach.

Color of flower cone.—The color of the bracts subtending the blossoms is almost all green with slight brown hues on the sides and top of each bract. It is therefore the easiest variety to distinguish when in a ripe condition.

Tendency to produce suckers.—I can safely say that it produces more stalks to the hill than either Maguindanao or Tangouan; the hill seems

to possess a round appearance due to the regularity of the root stock in sending out its suckers.

Quality of fiber.—If any difference exists between it and Maguindanao, one can not detect it with the naked eye. It is also about as easy to strip.

Quantity of fiber.—It is a shade less than in Maguindanao, 100 pounds of stalk contain about $1\frac{1}{3}$ to $1\frac{1}{2}$ pounds of dry fiber.

5. ARUPAN.

In general outward appearance this variety is very similar to Maguindanao and to most of the varieties to be described below, hence very few planters know of it or have even heard of it; it is very extensively grown, especially in the neighborhood of Davao.

That there is such a variety, can be easily shown by three particular characteristics which can not be shown in any other. These are the comparative shortness of the stalk, the comparative thickness at the top, and the redish color of the tuxy ten minutes after it is separated. This latter, in my opinion, is due to an excess of tannic acid, or to stronger acid than that found in other varieties.

Color of stalk.—Differing from Maguindanao in having more of green and less of shining color; it is also noted that the green is somewhat lighter than that found in Maguindanao.

Size of stalk.—It never grows to any considerable height, but in thickness the stalk does not fall far short of either Tangouan or Maguindanao.

Shape of stalk.—The least tapering of all varieties, the ratio between the two circumferences not exceeding $1\frac{3}{4}$ to 1.

Tendency to produce suckers.—In this respect it may be put down as equal to Maguindanao.

Quality of fiber.—Somewhat hard to strip, and dull in color, though not to the extent of Tangouan.

Quantity of fiber.—About the same, if not a little greater than in Maguindanao. From $1\frac{1}{2}$ to $1\frac{3}{4}$ pounds of dry fiber can be obtained from 100 pounds of stalk material.

6. LUMAWAAN.

We have only a few hills of this variety on our place, and at the time of preparing this paper none of these stalks are mature. Judging from experiments on immature stalks, I find that it contains as much fiber as either Arupan or Maguindanao, but of better quality than either of them. In general appearance it looks very much like Maguindanao, excepting in the leaves which shoot straight up as in most other varieties. It grows to a good height and size but does not send out many suckers. In my opinion, it is the plant called "Female Baguisanun" on the east side of the Gulf of Davao.

7. PUTEEAN.

A very bad reputation has attached itself to this variety, probably on account of its weakness of growth. It seems to grow well only on soft loams alongside a river or stream whose water occasionally overflows and leaves a rich deposit. In other places where the soil is somewhat harder and drier it fails altogether and hardly comes to anything worth caring for.

Color of stalk.—Somewhat darker and less shining than the Maguindanao.

Size of stalk.—At its best it never grows higher than 13 or 14 feet, while in thickness it can be safely said that it is the smallest, with the exception of agutay.

Shape of stalk.—The ratio between the two circumstances is as 2 to 1.

Tendency to produce suckers.—Somewhat less than in Arupan or Maguindanao.

Quality of fiber.—White, as the word implies.

Quantity of fiber.—One and one-fourth pounds dry fiber to 100 pounds of stalk.

8. BAGUISANUN.

It is just as easy to recognize this variety at first sight as it is to recognize the Tangouan. The light green color pervading the whole stalk down to the very base, as well as the great height and size to which the stalks grow, make it a very easy thing to identify this variety.

In making the tuxy, it behaves very badly. The tuxy often ends in the middle of the sheath, or toward the end, and the man can never pull the tuxy to the end, due to the weakness of the fiber. On this account, all strippers avoid Baguisanun as much as they can. If the stalks were left ten or fifteen days on the ground they could be tuxied, only the tuxy gets darker in color, and the fiber changes to a somewhat dull color.

Color of stalk.—As mentioned above, the stalk is almost all light green.

Size of stalk.—The stalks grow to a greater height and size than in any other variety.

Shape of stalk.—Thickness at the base about double that at the top.

Tendency to produce suckers.—It produces more stalks to the hill than any of the above varieties and the stalks are packed close to each other making it a difficult task to cut the mature ones from among them.

Quality of fiber.—White; also finer and weaker than any of the kinds mentioned above.

Quantity of fiber.—With the present wasteful method not more than 1 pound of fiber to 100 pounds of stalk can be obtained. A machine will save a great deal of the weak fiber wasted in tuxy making.

9. AGUTAY.

Among the 220,000 hills which we have on our place, I could not find more than three hills of this variety. Some years ago there were a good number of them, but as soon as their nature was revealed, they met their fate.

The same difficulty met with in ruxy-making in the Baguisanum is found here, the fiber being about as weak.

Color of stalk.—Deep green with dark lines, almost approaching Libuton.

Size of stalk.—I have not seen stalks over 11 feet in height and 1½ feet in thickness.

Shape of stalk.—Similar to Puteean.

Tendency to produce suckers.—Thirty stalks to the hill is not an uncommon sight; it has the greatest tendency to produce suckers.

Quality and quantity of fiber.—About the same as in Baguisanum.

CONCLUSION.

In applying the requisites of a good abaca plant to the above varieties, it will be seen that the best to pick seed or root sections from are the Tangouan, Maguindanao, Libuton, and Bangulanum, while the planter will be safe even with Arupan and Lumawaan. The Puteean, the Baguisanum, and the Agutay should be carefully avoided for the reasons above stated.

PERIODICALS NOW BEING RECEIVED BY THE LIBRARY OF THE BUREAU OF AGRICULTURE.

ENGLISH.

Agricultural Gazette, New South Wales.
Agricultural News, Barbadoes.
California Cultivator, Los Angeles, Cal.
Crop Reporter, Washington, D. C. (Published by the Secretary of Agriculture).
Exporters' and Importers' Journal, Chicago, Ill.
Far Eastern Review, Manila, P. I.
Farmer and Fruit Grower, Jacksonville, Fla.
Farmers' Guide, Huntington, Ind.
Farm Press, Chicago, Ill.
Federal Reporter, New York, N. Y.
Hawaiian Forester and Agriculturist, Honolulu.
Hemp Market Report, Landauer & Co.
Ide and Christie's Monthly Circular.
Independent Farmer, Lincoln, Nebr.
Iowa Agriculturist, Ames, Iowa.
Journal of Agriculture and Horticulture, Montreal, Canada.
Journal of the Department of Agriculture, Victoria.
Journal of the Department of Agriculture, Western Australia.
Kansas Farmer, Topeka, Kans.
Louisiana Planter, New Orleans, La.
Memoirs of the Department of Agriculture, India.
Natal Agricultural Journal.
Official Gazette, Manila, P. I.
Oregon Agriculturist.
Philippine Journal of Science, Manila.
Progressive Farmer, Raleigh, N. C.
Queensland Agricultural Journal.
Smith and Schipper's Monthly Report, New York.
Southern Cultivator, Atlanta, Ga.
Tropical Agriculturist, Colombo, Ceylon.
Tropical Life, London.
West Indian Bulletin, Barbadoes.

SPANISH.

Anales Agronómicos, Santiago, Chile.
Boletin de Agricultura, Costa Rica.
Boletin de la Cámara de Comercio Filipina, Manila, P. I.
Hacienda, La, Buffalo, N. Y.
Hacendado Mexicano, El, Mexico.
Prácticas Modernas é Industrias Rurales, La Coruña, Spain.

OTHER LANGUAGES.

Berichte uber Land-und Forstwirtschaft.
Der Pflanzer.
Boletim de Agricultura, Sao Paolo.
Boletim de Museu Goeldi, Para, Brazil.
Bulletin de la Chambre de Commerce de Saigon.
Bulletin Econimique, Indo-China.
Journal de Agriculture Tropicale, Paris.
Tamil Journal of South Indian Agriculture, Madras, India.

PLATE I. NATIVE FEMALE PAPAYA TREE WITH FRUIT GROWING IN SINGALONG.

THE PHILIPPINE

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EDITORIAL.

INTERNATIONAL RUBBER AND ALLIED TRADES EXHIBITION, LONDON.

The leading article of this number of the REVIEW is an extract from the report of Mr. R. Derry, co-commissioner for Malaya, on the International Rubber and Allied Trades Exhibition held in London, September 14 to 26, 1908.

In many respects this is the most comprehensive article on the rubber industry which the REVIEW has been able to present. Mr. Derry carefully takes up the different families and species of the rubber plant which

are raised in the various countries of the world and discusses the cultivation and production of each kind, in a manner which will be very instructive to those interested in the rubber industry.

The most interesting features of this report are Mr. Derry's statements regarding the plantation industry. He states that more than two-thirds of the supply for the rubber markets of the world to-day come from the wild forests of rubber trees in South America, Africa, Eastern and Indo-Malaya; that the rubber plantation industry is in its infancy,—the whole output of plantation rubber amounting to less than 38,000 tons as compared with a total output of over 103,000 tons; and that Manaos, and not Para, is the largest port for rubber in the world. It is very evident that when the large number of rubber plantations which have been started in the Federated Malay States, Ceylon, and other parts of the world, come into bearing, as they will in a few years, there will be a decided increase in the output of plantation rubber. He also points out that the wild rubber forests are being gradually exhausted making it clear that we must soon depend largely upon plantation rubber to supply the demands of the world's market.

That part of the report relating to the Allied Trades Exhibit of manufactured rubber, such as tires for carriages and automobiles, tiling, mats, sheets, ebonite, gutta-percha, athletic goods, and the almost innumerable list of articles which are made from rubber, as well as its use for tanning hides, would indicate the infinite uses which may be made of the product of the rubber tree and the consequent increasing demand for it in the markets of the world.

RICE CULTURE IN THE PHILIPPINES.

From the report of the Collector of Customs for the fiscal year ending June 30, 1908, it is seen that the rice importations during the year amounted to 357,532,514 pounds, valued at $5,861,256, or 19 per cent of all the imports for the year, representing an increase of 43 per cent over the quantity imported during the previous year. Rice from the French and British East Indies and Siam constituted the bulk of this trade; the importations from French East Indies amounting to 336,156,116 pounds; those from Siam to 18,562,337 pounds, while British East Indies contributed 2,660,258 pounds.

Although the value of the rice imported during the fiscal year was $5,861,256, as above stated, duties were paid on these imports amounting to $1,254,515. It is easily seen that had the rice necessary to supply the demand in the Philippines been raised by the agriculturists of these Islands, the people of this Archipelago would have been not only ₱11,722.512 richer by reason of the value of the amount of rice imported, but in addition to this they would have been ₱2,509,030 richer.

the amount which they paid out for duties thereon. In short, had the farmers of the Philippines raised and harvested enough rice to meet the demands for home consumption there would now be ₱14,231,542 more in circulation in these Islands, instead of in the French and British East Indies and Siam, as it is to-day.

In response to the request by the Director of Agriculture dated December 9, 1908, for further information regarding rice culture in these Islands, a number of reports have been received and two of them are presented in this number of the REVIEW. These articles, "Rice Culture in Nueva Ecija," and "Rice Conditions in Bataan and Pampanga" give the local classification and names of the varieties cultivated in those sections and the uses made of them. In most cases the names of the different varieties seem to have only a local significance, and are of little or no value in an exact or scientific classification. Without doubt many of the varieties which appear under different names belong to the same family or species, although presenting the variations indicated.

In this connection also, some attention has been given to the insect enemies of the rice plant and the diseases which have been reported in the provinces mentioned.

It is the desire of this Bureau to make a careful and thorough study of rice cultivation in these Islands with a view to determining the varieties planted at present, and assisting farmers in selecting for future planting those varieties which are of most value, which give the largest yield, and bring the best prices in the local markets; as well as, to determine the best means of eliminating the insect enemies and diseases of the rice plant; to the end that Philippine farmers may be encouraged to supply the demands of the home market for rice, and thus enrich the country, from its present status, to the extent of ₱14,231,542 annually, by putting this amount of money into circulation in these Islands, instead of in French and British East Indies and Siam.

PANAMA HATS.

It is desired to call the attention of our readers to the article in this number of the REVIEW on the Panama hat industry, by United States Consul-General Alban G. Snyder, of Bogotá, and Consul P. P. Demers, of Barranquila, Colombia.

From the statements of these gentlemen, it will be seen that *Carludovica palmata* is used in the manufacture of hats in Panama and Colombia the same as buri, nito, bejuco, sabutan, nipa, and other palm products are used by the people of the Philippine Islands for the purpose of making petacas, hats, and mats or petates.

From the process described by Consul-General Snyder it is seen that

the methods employed in Panama and Colombia are almost identical with those used by the makers of petacas, hats, and mats in Dumarao and other towns of Capiz Province, Baliuag in Bulacan, Calasiao in Pangasinan, and some towns in Batangas.

From the further description and statements regarding the cost of these hats, made by Consul Demers, it will be seen by those familiar with the industry that the same conditions which are regarded as favorable in the Philippines are so considered in Panama and Colombia. Perhaps the most difficult part in the whole process of hat making, and the only one that requires an expert, is that of boiling and preparing the crude product for use in weaving hats and mats.

It will be seen that the most expensive hats which have sold in time past, and even now sell at exorbitant prices, in some instances as high as $150 each, cost but little more than $60 per dozen.

In case the plants of *Carludovica palmata* which have been set out at the Lamao Experiment Station do well and develop satisfactorily in these Islands, there would seem to be no reason why this most profitable industry could not be taken up and carried on by some enterprising person in the Philippines with comparatively little capital.

SUPPLY AND DEMAND.

The continued low price of hemp, which is one of the most staple products of the Philippines and one upon which planters for years past have relied as an unfailing source of income, and the unusually large crop of sugar which is promised in the Visayas, call attention to the very important questions of supply and demand.

In the United States as well as in the Philippine there has always been a tendency on the part of farmers to select one crop, generally a staple which promises a good profit, and give their attention to it to the exclusion of almost all other agricultural products which might be grown as easily as this one crop, to which they devote nearly all of their time and money. In such cases it is always the experience of farmers that at intervals the price of their staple crop falls and they realize scarcely any profit; some times their crop is a financial failure because there is no demand for it in the market.

It is desired to call the attention of agriculturists in the Philippines to the fact that it is of the utmost importance that they study carefully the demand of the local and world markets not only of to-day, but the probable future demand for the leading agricultural staples—crops which in view of commercial conditions will be needed in large quantities and will consequently command high prices. The farmer who plants and harvests a crop without studying carefully the conditions of supply

and demand in the local and world markets is sure, sooner or later, to suffer unnecessary loss in his business, if not at some time the total loss of the crop which he harvests, because there is no demand for it.

This failure to study the conditions of supply and demand is, perhaps, well demonstrated by the large crops of unharvested hemp, and hemp stored in camarins, not only in the Philippines, but in New York and London, for which there is little demand, and on account of which there has been a prevailing low price for this product. As to whether the price of hemp will ever go up to its old standard depends not only upon the demand for the products which hemp is used to make, but on the other hand as to whether other plants which are being cultivated at the present time can supply a fiber to take the place of hemp, at a lower price.

The conclusion, perhaps, of the whole matter is that security for Philippine agriculturists, as well as for farmers in the United States, is to give attention to and to cultivate such a variety of crops as their lands will produce with profit. The fact that in the Philippines hundreds and perhaps thousand of agriculturists, year after year, have depended almost entirely upon the income from one crop (hemp, sugar, or tobacco), to the practical exclusion of all others, has been the cause of many hardships not only to the planters but to those dependent upon them for employment. In many cases, this lack of demand for a certain agricultural product has worked hardships to the common people in the hemp, sugar, and tobacco sections which only those living in these sections realize. We must not look forward to free exports into the United States or free imports into the Philippines as a panacea, or expect them to bring prosperity and progress; *we must produce the articles demanded by the local and world markets.*

THE DIRECTORY.

In this number of the REVIEW we are giving a directory of the Bureau of Agriculture with the idea that it may be a help to those interested in our work and assist in the dispatch of the business of this Bureau with the public. It is hoped that those desiring to take advantage of the services of any department or branch of the Bureau of Agricultural at the central office, stock farms, experiment stations or veterinary offices may, by the help of the directory, do so with the greatest economy of time both to themselves and the officers of the Bureau.

PLATE III. ROUND VARIETY OF PAPAYA FROM HAWAIIAN SEED.

PLATE IV. LONG VARIETY OF PAPAYA FROM SINGAPORE SEED.

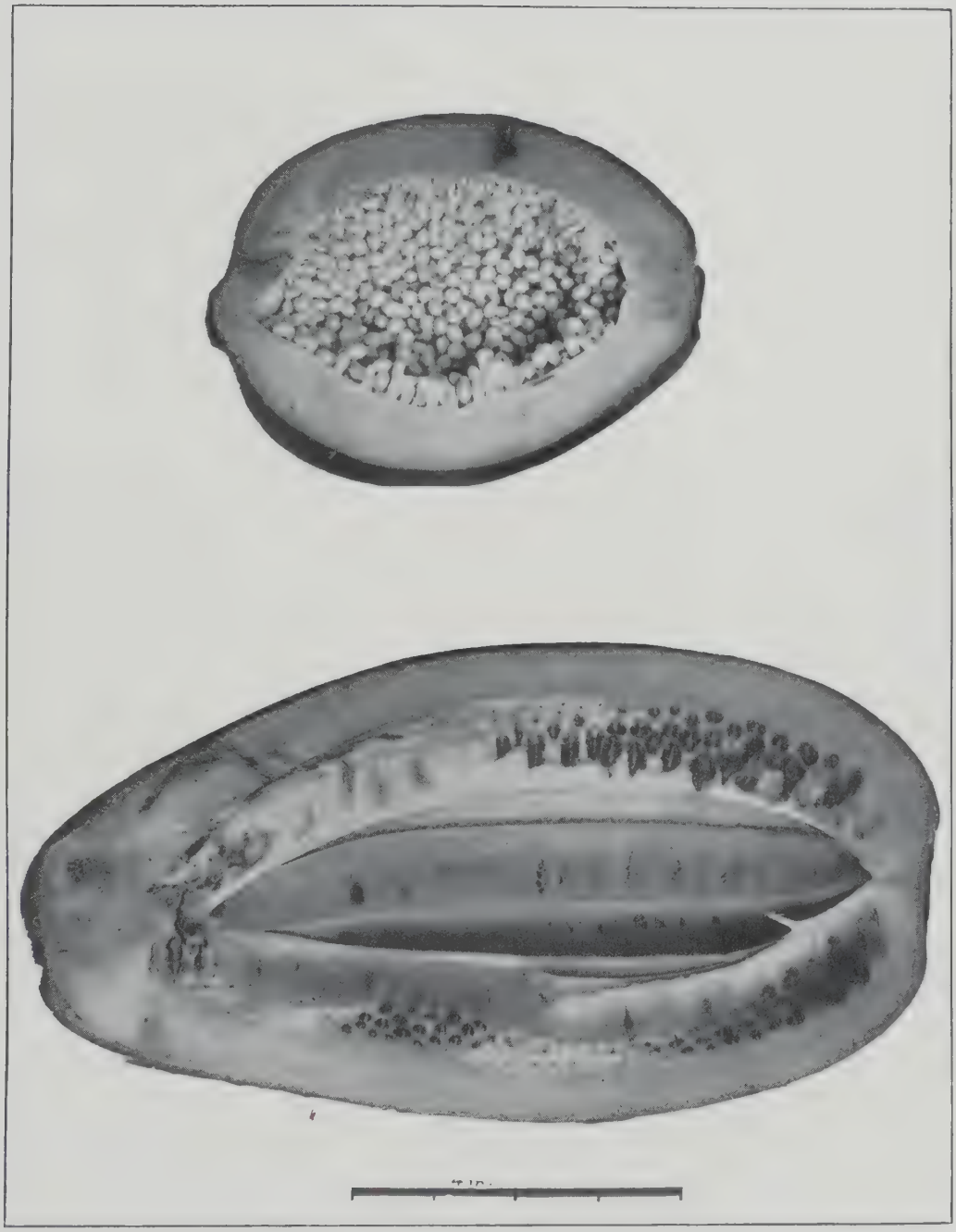

PLATE V. FRUIT OF LONG AND ROUND VARIETIES OF PAPAYA CUT OPEN.

THE PANAMA HAT INDUSTRY.

By Alban G. Snyder,

United States Consul-General, Bogota, Colombia,[1]

and

P. P. Demers,

United States Consul at Barranquila, Colombia.[2]

Owing to the large demand for Panama hats, Americans may be desirous of engaging in the business. I see no reason why the "palmicha" palm would not grow readily in the Philippines. Anyone desiring to start this industry there can get an expert boiler and hatter in Colombia at small cost to teach the art.

These hats are made from the common fan-shaped palm, called "palmicha," which grows wild in abundance, generally in moderate climate and fairly moist ground. Young shoots, uniform in size, are cut from the plant and boiled to a certain stage, being softened thereby and brought to a light yellow color.

The process of boiling appears to be an art in itself, and only a few people can turn out good straw. The boilers sell the straw at so much a pound, according to the quality and the prevailing prices of hats.

When the proper boiling point is reached, the shoots are put up to dry and the leaves quickly separated. This is done indoors where there is a current of air but no sunshine. When the leaves are nearly dry they are split with a little Y-shapped wood instrument, so that every good leaf is the same size. When left alone to dry the leaves curl in at the edges and are then ready for use. At this point the straw is carefully wrapped in clean cloths, as the light and dry atmosphere spoil it. When finished the straw is carefully pared with a pocketknife and then battered all over with a small hand maul, after which it is washed with common yellow soap and a little lime juice and left to dry, away from the sunlight.

In the Suaza district they make the hats on solid wooden blocks, two to four persons—generally women—sitting opposite each other and working steadily. Four women can make an average quality hat in six or seven days, while a fine one requires three to six weeks.

[1] From United States Consular Report for April, 1904.

[2] From United States Consular and Trade Report for March, 1907.

The hats made in the Suaza district in Colombia are considered much superior to those made in Ecuador. About a year ago an average Suaza hat cost about 45 cents first hand, a good one $1.50, and a very fine one $3; but prices have varied according to the demand and during the last two years they have been rising steadily, and now, at times, as high as $5 and $6 is paid for them—and not the very finest at that.

The manufacture of these hats is affected to a great degree by climatic influences, an expert hatter being unable to make as good a hat in the dry summer weather as during the rainy season; probably on this account hats in some parts of the Suaza district are superior to those made just a short distance away.

Long training is necessary to become a good hatter, and the girls are started at the work at the very early age of 10 years and must practice constantly. Hatters work every day from early morning, wasting very little time in eating, and often carrying on their work by candlelight so as to finish in time for market, for an hour may mean to them the loss of a market day and the corresponding inconvenience caused by failure to receive the money which would have been acquired from the sale of the hat.

Consul P. P. Demers states, in a letter from Barranquila, that one of the important industries of the Republic of Colombia is that of making palm hats, known as Panama hats, of which nearly $400,000 in value are exported annually.

This industry follows in importance those of coffee, gold, hides, cattle, tobacco, and rubber, in the order named, and is carried on in the departments of Cundinamarca, Tolima, Antioquia, and Santander, but mostly in the latter where it is the breadwinner of more than one-half the population. There are no regular factories, but the hats are handmade by thousands of peasant women in almost as many households and sold or traded in the local stores in exchange for provisions or articles of clothing, the hat being in these regions a convenient medium of exchange, the housewife exchanging the product of her labor for so many pounds of flour, sugar, etc.

HOW PANAMA HATS ARE MADE.

Panama hats are made with the veins or fibers of palm leaf, the tissues of which are scraped off or combed in much the same way as hemp. The palm (*Carludovica palmata*), called locally "jipijapa," is very small in appearance and grows in great quantities on the low and swampy lands of the upper Magdalena. It grows wild but is also cultivated, although to a limited extent, in the largest hat districts, the palm producing in a little over a year. The preparation of the fiber after the tissues have been combed off consists of boiling the same in water containing salt and lemon juice for whitening and rounding its surface; this operation takes a few hours. The straw is then exposed

to night air for three consecutive nights, after which it is ready for use. The material employed in the making of a hat is marketed at from 15 to 40 cents, or the equivalent thereof, per hat, according to the fineness and whiteness of the straw, the youngest leaves generally giving the best quality. It takes a woman four days to make an ordinary hat, eight days for a good one, and as many as fifteen days for the finest hat made in Colombia. The salary of the peasant woman employed in the making of a "jipijapa" hat is reckoned at 10 cents a day, including her food, which can be calculated at 10 cents additional.

The best hats exported from this country are those called "Suaza," made in the city of that name in the Department of Cundinamarca. The next in order are the "Antioqueños," made in the Department of Antioquia. Then follow the ones made in the Department of Santander, called, respectively, "Zapatoca," "Barichara," "Bucaramanga," and "Giron," from the various cities in which they are made, and varying in quality and price in the order named. But the "Zapatoca," although the most expensive from Santander, are supposed to be less durable.

METHOD OF SHIPPING.

The best Suaza hat exported costs on the premises $5, the cheapest of all being those from the Department of Santander, which range from 50 cents to $2, according to the quality. Indeed, some Panama hats, made at the rate of one a day, sell for less than 50 cents but these are made exclusively for home consumption and are not exported.

Hats are generally exported by the local merchants, mostly through the agency of a commission house at the port of shipment. In some cases foreign houses buy direct, whereas a few individuals take their own merchandise to the foreign country where it is marketed by them personally. The hats are packed in boxes weighing 132 pounds and containing from 40 to 50 dozens each. The shipping costs, per box, are as follows: Packing and boxing, $2; mule freight to river port, $1; river freight to port of shipment, $1, plus 1 per cent ad valorem; freight to New York, three-fourths of 1 per cent, or 20 cents per cubic foot, plus 5 per cent, should measurement be more than value; commission, etc., about $1 per box. Thus boxes containing 40 dozens of the best $5 Suaza hats, and the cheapest kind exported, 50 cents, will cost in New York the following:

Item.	Best Suaza.	Cheapest.
Purchase price	$2,400.00	$240.00
Packing and boxing	2.00	2.00
Mule freight to river	1.00	1.00
River freight to port of shipment	25.00	3.40
Commission, etc.	1.00	.50
Freight to New York	18.00	1.30
Total cost of 40 dozens	2,447.00	248.20
Total cost per dozen in New York	61.17	6.20

Panama hats exported from Colombia to the United States may then vary in value from $6.20 to $61.17 per dozen. It is absolutely impossible, without examining the contents of each box, to put the right value on an average shipment, as it is the custom here to include many classes of hats in the same box. It can be rightly supposed, however, that the average hat exported to the United States from this country is at least of a fair quality.

GROWTH OF EXPORTS TO AMERICA.

The first Panama hat sent from this port to the United States was in 1899, and the trade to the present time has increased, as the following statistics of Panama hats exported to the United States from Barranquila alone will show, for the fiscal years which ended June 30: in 1899, $536; in 1900, $518; in 1901, $14,425; in 1902, $84,342; in 1903, $112,649; in 1904, $111,103; in 1905, $79,448; and in 1906, $151,676. The figures given represent the declared value in the consular invoices, averaging approximately 75 cents per hat, a very low estimate.

As above explained, Panama hats are made in a most primitive way. Accordingly, any machinery invented which could increase the output materially and at the same time reduce the number of employees would be a great benefit to the industry which is very attractive, since it needs but a small capital and promises good returns to anyone engaging in it systematically.

(Ten plants of this species (*Carludovica palmata*) were recently imported from Ceylon and planted about March 6, 1909, at the Lamao experiment station, for trial and propagation, if satisfactory.—EDITOR.)

THE AGRICULTURAL CONGRESS OF PANAY AND NEGROS.

By the EDITOR.

Probably one of the best movements ever made for the agricultural progress and prosperity of the southern islands is that of the Agricultural Congress of Panay and Negros, the second annual meeting of which took place at Iloilo on January 30, 31 and February 1, 1909. This meeting was attended by two or three hundred delegates from Panay, Negros, and the surrounding islands of the Visayas, including not only the leading farmers and business men of that section, but also several members of the Philippine Assembly, among whom were Señores Hernandez, Avanceña and Jalandoni of Iloilo, Villavet of Antique, and Rodriguez of Cebu. The Bureau of Agriculture was represented by Sr. Tecson, superintendent of the agricultural extension work.

The following program was carried out, with a few slight variations, under the chairmanship of Señor Juan de Leon, provincial fiscal of Iloilo:

PROGRAM.

1. The necessity of increasing the capital stock of the Agricultural Bank of the Philippines, by Señor J. Lopez Vito.

2. Legislation covering the relations between capital and labor, employer and employee, by Señor J. Hernandez.

3. The importance of taking steps to obtain the greatest advantage in disposing of the sugar product of the Visayas, by Señor E. Guianko.

4. The necessity of a Government loan for the purpose of establishing a Philippine irrigation system, by Señor R. Montinola.

5. The necessity of establishing a Government station in Iloilo for grading and regulating the tare on sugar, by Señor F. Villanueva.

6. A law providing for the improvement of the port of Iloilo and dredging the rivers of Panay and Negros, by Señor Juan de Leon.

7. Better laws to facilitate obtaining titles to agricultural lands, by Señors Vicente Franco and J. Hernandez.

8. The advantages of scientific and varied cultivation, by Dr. G. E. Nesom.

9. The need of improving the animal industry, by Señor Jose de la Rama y Gonzaga.

10. The necessity of establishing agricultural and veterinary colleges in all provinces of the Archipelago, and the further introduction of practical agricultural instruction in the primary and secondary schools, by Mr. Charles H. Magee.

11. A law providing for the exemption of the tax on carts having less than 2-inch tires when the same are used only on the farms of the owners and not on the public roads, by Señor Vicente Gamboa Benedicto.

12. The importance of encouraging the organization and establishment of agricultural fairs and expositions in different sections of the Islands, by Señor N. Severino.

13. Which of the various lines of railroad projected on the Island of Negros will most benefit the agriculturists of the island? by Señor S. Laguda.

14. The necessity of requiring a fixed number of government students to take an agricultural engineering course, by Señor M. Fernandez.

The question of the establishment of a Government station for the grading of sugar in Iloilo was discussed at length, and communications regarding the matter were sent to the Governor-General and the Philippine Legislature. It was believed that such a station, if established, would be a great benefit to the sugar growers of Panay and Negros, and that the chief or superintendent of the same should have full authority under the law to determine the grading of all sugars bought and sold in those sections. It was also recommended that the Government establish a court which should have jurisdiction over all cases arising from the sale of sugar or the dealings of those engaged in the sugar business, the expenses of the same to be paid by those utilizing its services.

One of the resolutions passed by this congress recommended the establishment of a serum laboratory in Iloilo and a quarantine station in Occidental Negros.

The congress also seemed to be under the impression that the present force of the veterinary division of the Bureau of Agriculture is insufficient, and that a larger number of competent veterinarians should be employed to keep down the prevailing cattle diseases.

With reference to the work of this congress, the editor is very forcibly reminded of the following statement made by Prof. Edward C. Parker, who was recently employed by the Fengtien government to establish the Agricultural College and Experiment Station at Mukden. Speaking of agricultural development in Manchuria, Professor Parker says:

> The agricultural problem in Manchuria is not so much the problem of making two blades of grass grow where one grew before, as to change the existing economic and social conditions of farm life into an advanced condition of commercial agriculture in which the farmer can produce a surplus of food above local demands and find a ready cash market for that surplus. * * * If good roads could connect with railways and waterways in Manchuria and if capital could organize the facilities for storing and shipping staple agricultural products, thus bringing relatively high prices for these products into every community, there is little doubt but that Manchuria would produce a large surplus of crops for export and in striving to produce a surplus the farmer would be quickened and fully awake to the advantages of improved methods of agriculture.

The above statement of conditions in Manchuria applies equally well to the Philippine Islands. Our need is to change the existing social and economic conditions of farm life, to build good roads, and railways, and to improve waterways, in order to stimulate production by bringing higher prices for farm products into every community.

THE PROVINCIAL BOARD OF TAYABAS AND ENEMIES OF AGRICULTURE.

By the EDITOR.

The attention of provincial boards throughout the Islands is invited to the following resolutions recently passed by the provincial board of Tayabas with reference to the appearance of locusts and surra in that province.

LUCENA, TAYABAS, *September 25, 1908.*

Whereas in various municipalities of the Province of Tayabas it has been shown that there are locusts which threaten to decimate the growing crops to such an extent as to constitute an agricultural plague; and

Whereas section 13, paragraph (*k*), of the Provincial Government Act provides that provincial boards shall enact rules for the stamping out of agricultural plagues:

Therefore, the undersigned, provincial governor of Tayabas, proposes for the approval of the provincial board the following rules for stamping out the locust or grasshopper plague:

I. Any person who discovers locusts or grasshoppers at any place in the Province of Tayabas shall immediately report the same to the teniente of the barrio where said locusts or grasshoppers exist and the said teniente shall immediately notify all the capable inhabitants of the barrio, together with the teniente and inhabitants of the adjacent barrios that they will be required to give their services for the extermination of such locusts or grasshoppers. He shall also immediately report the case to the local authorities of his municipality.

II. Any local authority who receives notice of the existence of locusts of grasshoppers within his municipality shall report the same to the presidente, who shall order all of the councilors of the municipality to coöperate with the inhabitants of the respective districts in the extinction of said pests. The presidente shall also report to the provincial governor the existence of locusts or grasshoppers within his municipality, stating what steps have been taken for their extinction. He shall, if possible, call a special meeting of the municipal council for the purpose of adopting proper measures regarding the extinction of the locusts or grasshoppers and should funds be necessary for this work, the council shall vote the required amount from the general funds of the municipality; and in case the municipality has not sufficient funds on hand therefor, the council shall ask for assistance from the province.

III. The municipal presidente and councilors of any municipality where locusts or grasshoppers appear in such numbers as to become an agricultural pest or plague, shall constitute themselves a board to direct the work of extinction.

IV. Every person who is subject to the last two rules above set forth and who fails to fulfill the conditions thereof, shall be declared guilty of a public offense and fined an amount not to exceed ₱200, or imprisoned not longer than

thirty days, in the discretion of the justice of the peace who, in the judgment of the provincial board, is competent to try all violators of these rules.

V. The amounts accruing in each town from fines or infractions of these rules shall constitute a special fund which shall be deposited with the municipal treasurer for the purpose of defraying the necessary expenses of the work of stamping out the locusts or grasshoppers, under the direction of the municipality.

VI. Six official copies of these rules shall be sent to each municipal secretary of this province, one of which shall be for the justice of the peace, and the other five shall be posted in the most conspicuous places in the town. Official copies shall also be furnished the judge of the Court of First Instance of Tayabas, and the Director of Agriculture, Manila.

Approved:

DOMINGO LOPEZ, *Provincial Governor.*
LUCIANO L. SANTOS, *Secretary.*

LUCENA, TAYABAS, *October 12, 1908.*

Whereas the animal disease known as surra is said to exist in the Island of Marinduque; and

Whereas the said disease has spread to some municipalities of this province by infection from diseased animals exported from the said Island of Marinduque; and

Whereas, if this evil is not removed, not only will agriculture suffer locally in this province but in the Islands generally:

Therefore, in compliance with paragraph (*k*), section 13, of the Provincial Government Act, the provincial board of Tayabas enacts the following rules for the stamping out of this disease.

I. The exportation of cattle from any port of the Island of Marinduque to the towns of this province, or other provinces in the Philippine Islands, is prohibited indefinitely; except for the port of Santa Cruz, from which cattle that have been previously certified by the Government veterinarian as healthy and unable to carry infection to other animals, may be exported.

II. Every violation of this resolution shall be punished by a fine of not to exceed ₱200, or imprisonment not to exceed 30 days, or by both such fine and imprisonment, in the discretion of the justice of the peace who trys the case. Justices of the peace of the said subprovince of Marinduque shall have power to try all persons who violate the provisions of this Act.

III. These rules shall take effect on October 14, 1908, and shall remain in force until otherwise ordered by the provincial board.

IV. Seven official copies of these rules shall be sent to each municipal secretary of the subprovince of Marinduque, one of which shall be furnished to the justice of the peace, one to the municipal-president, and the other five shall be posted in the most conspicuous places in the town. Official copies shall also be furnished the judge of the Court of First Instance of Tayabas, and the Director of Agriculture, Manila.

Approved:

DOMINGO LOPEZ, *Provincial Governor.*
LUCIANO L. SANTOS, *Secretary.*

The prompt action of the provincial board of Tayabas on the occasion of the appearance of locusts and surra in that province is most heartily commended by this Bureau, inasmuch as in times past it has seemed to be the custom of municipalities and even provinces to immediately

call upon the Bureau of Agriculture or the Insular Government for help without taking the necessary preliminary steps or precautions such as were taken in the cases above mentioned to prevent the spread of the pest or plague.

In this connection the attention of provincial and municipal officials, as well as that of the reader, is invited to the very simple instructions regarding rinderpest, surra, foot-and-mouth disease, anthrax, hog cholera, glanders, hemorrhagic septicemia, and ulcerative lymphangitis contained in Volume I, No. 3, of the REVIEW for March 1908, also General Order No. 13, by the Bureau, published in Volume I, No. 11, of the REVIEW for November, 1908.

By following these instructions provincial officials will find it easy to confine a pest or plague to the locality in which it appears until it can be eradicated by the local authorities or by the assistance of this Bureau and such other Insular aid as may be necessary. In many cases prompt action by municipalities and provinces following out the above mentioned instructions will be all that is necessary without assistance from the Insular Government. While this Bureau is anxious to give all the assistance it can to provinces and municipalities throughout the Islands, the efforts made in some provinces to stamp out diseases which have appeared in different parts of the Islands are greatly appreciated. Without such coöperation by municipalities and provinces it is impossible to get results, while in most cases much more can be accomplished by them toward the eradication or stamping out of the dangerous animal diseases in the Islands than by any other department of the Government.

BRASSOLIS ISTHMIA, A COCONUT PEST IN PANAMA.

A LEPIDOPTEROUS INSECT HIGHLY INJURIOUS TO THE COCONUT.

The attention of coconut growers in these Islands is called to the following facts regarding the above insect, from a report of Mr. Henry F. Schultz, Horticulturist for the Canal Zone, Isthmus of Panama.

Early in May, 1906, the majority of the coconut trees in the neighborhood of Ancon were defoliated by the attacks of a caterpillar. Large trees which had been bearing crops for a number of years stood without a particle of foliage with their bare petioles and midribs resembling skeletons. Some of the trees had to be cut down but the remainder recovered under the special care given them.

Later in the same year, about the middle of September, the caterpillars again appeared, although not in as large numbers as before, and began to strip the trees anew. All coconut trees were, therefore, sprayed with a strong solution of arsenate of lead, a most tedious and troublesome, although very effective, method of fighting these insects, in view of the height of the tree, which were mostly from 30 to 35 feet. Although torrential rains washed off the arsenate of lead after a few weeks, it stayed on long enough to kill all the insects on the trees which had received treatment.

This year the caterpillars made their appearance again in May. Apparently this is the time of year when the mature insects deposit their eggs freely on all coconut trees in the vicinity, for about the latter part of August thousands of their larvæ began to defoliate these palms again and were evidently determined not to leave a single leaf on the trees. However, one fact was noticed, viz, that the larvæ feed only at night and that they retire before the first rays of the sun into a tough webb spun with pinnæ of the leaves, where frequently as many as 700 to 800 crowd together in one nest. The lower part of this, where the ends of the pinnæ meet, is left slightly open and the nest presents the appearance of a long narrow bag from 30 to 60 centimeters in length, according to the number of insects it contains. Frequently a tree will have two, three, or even four of these nests and some were found where the number of full-grown larvæ were estimated to be over 2,000. What even half of this number can do to a full-grown tree if their ravages are not speedily stopped can be imagined, especially if the fact is kept in mind that they attain the respectable size of 5 to 10 centimeters in length and have enormous appetites like most caterpillars.

A bearing coconut tree will thus be stripped of every inch of its foliage in a few nights and receive such a severe check in its growth that even with all due care in preventing the reappearance of the pest in following years, at least two or three crops of nuts will be lost, and it is no rare occurrence that a tree dies outright or becomes so weak that it can not resist fungoid and other diseases, and gradually perishes.

After reaching maturity or when the supply of food gives out, the larva passes into the chrysalis stage, in which it remains twelve to sixteen days, and this is the time when the larvæ of an apparently dipterous insect help in the extermination of *Brassolis*. It has been impossible to determine whether the mature parasite deposits its eggs into the skin of the caterpillar or into the chrysalis, or whether its ova are introduced through the alimentary tract of the larvæ with its food. Dr. Darling, chief of the board of health laboratory at Ancon, has examined mature larvæ of *Brassolis* under a high-power microscope without finding any traces of parasitic ova in either the skin or the intestinal ducts. However, as only a small number were examined on account of lack of time, it is possible that the few specimens observed were not infected with parasites.

As the parasitic larvæ are not protected with a skin, which in the judgment of the writer would be tough enough to withstand the gastric juices of *Brassolis,* the probability of cutaneous infection suggests itself. The destruction of *Brassolis,* through its parasites seems to be rapid, though the actual time can not be given, as those in captivity seem to be free from infection.

As previously stated, the larvæ feed only at night and try to hide in their nests during the day, but this hiding becomes in realty a means of their being more easily detected and destroyed, for it is a great deal easier to cut down these nests than to spray the trees. However, this requires constant vigilance on the part of the grower, as in the groves where the tree tops frequently touch each other the caterpillars can crawl from tree to tree.

The writer seems to believe that *Brassolis* is one of the most formidable enemies of the coconut grower if it is allowed to spread, and that every possible attention should be given to the immediate destruction of the larvæ at their first appearance.

The *Brassolis isthmia* has also been found on the following palms: *Martinezia caryotaefolia, Acrocomia solerocarpa, Oreodoxa regia, Oleracea,* and two unidentified species of *Thrinax.*

Any coconut growers who find that *Brassolis isthmia* has made its appearance in these Islands are requested to advise the Bureau of Agriculture at once, giving all the details possible with reference to its ravages in their vicinity.

RICE CULTURE IN NUEVA ECIJA.

The following data concerning rice culture in the Province of Nueva Ecija were furnished by Mrs. C. D. Whipple and the pupils of the provincial school in San Isidro at the close of the harvest for 1907–8.

The rice of this province is grouped three times—

1. According to whether it is with or without a beard or awn.
2. According to whether it is harvested early or late.
3. According to food quality.

All the bearded varieties are grouped as "palay-Iloco," and those without a beard as "palay-Tagalog."

All varieties harvested between July and November are grouped as "paaga" (early harvest), and those harvested after November as "pahuli" (late harvest).

All varieties that may be used to form the greater part of a man's daily food are placed in a group called "macan," while those that are hard and difficult of digestion are placed in another group called "malagkit."

"Palay-Iloco," or the bearded varieties, require less cultivation than the "palay-Tagalog," or beardless varieties, but have less commercial value because of the difficulty in harvesting and thrashing. "Palay-Iloco" can not be thrashed by carabaos like "palay-Tagalog," but is separated from the straw by pounding small quantities at a time in a mortar.

It is cut three or four stalks at a time with a short knife and tied into small bundles or bunches. Six of these little bunches make a "ponpon" and forty-four "ponpons" make an "hoyon." This is the way "palay-Iloco" is measured and when harvesting these bearded varieties it is the custom to give the harvesters every fourth or sixth bunch in addition to the regular daily wages, but this custom does not pertain to the beardless varieties.

"Palay-Iloco" will also produce a crop with less water than "palay-Tagalog," but in spite of this and other advantages it can not be raised in paying quantities without machinery for harvesting and thrashing.

"Macan" and "malagkit" may be either "paaga" or "pahuli." Of "macan," "mimis" is considered the best variety. "Malagkit" is never used for food in large quantities, but is ground into a fine flour and used for making cakes and several different kinds of sweets. When it is in the "dough" it is pounded and roasted and eaten with sugar and coconut

milk. This is called "pinipig" and many Americans like it as a breakfast food.

In the following list are the names of the varieties of rice raised in Nueva Ecija which were classified by the pupils in the provincial school.

Varieties.	Macan.	Malagkit.	Palay-Tagalog.	Palay-Iloco.	Paaga.	Pahuli.
Mimis	*		*		*	
Sinanpablo	*		*		*	
Macancumpol	*		*			*
Minalit	*		*			*
Magulhay	*		*			*
Ipotibon	*		*			*
Magasa	*		*			
Binulagsac	*		*			
Binundoc	*		*		*	
Pulangbalat	*		*			*
Binato	*		*		*	
Inalsa	*		*			*
Salamani	*		*			
Maranaga	*		*		*	
Bansuray	*			*		
Kinastila	*			*		
Granado	*			*		*
Malayusa	*			*		
Payos	*			*		
Minantica	*			*		
Guinarcia	*			*		*
Quinalabas		*	*		*	
Pirurutong		*	*		*	
Milagrosa		*	*		*	
Pinino		*	*		*	
Nilihim		*	*		*	
Bansuroy						*
Kinamias	*			*		*
Caviteña	*		*			*
Binacal	*			*		*
Sampurin	*			*		*
Calibo	*		*		*	
Dinalaga	*		*		*	
Sinantol	*				*	
Sinaguing	*		*		*	
Virenghena	*		*		*	

The following notes were made by the division superintendent of schools on ninety-one varieties of rice, samples of which were forwarded to him by the teachers and pupils in the Province of Nueva Ecija at the close of the harvest for 1907–8.

1. Alamang (shrimp). Bearded, light red, plump grain.
2. Bansuroy. Bearded, light red, round grain.
3. Barlaque. Bearded, light red, small grain.
4. Bincal, (iron).
5. Binaaruy. Bearded, light brown, small grain.
6. Binanata. Bearded, light red, very small grain.
7. Binandera (flag). Bearded, light brown, plump grain.
8. Binara (vara). Bearded, light red, round grain.
9. Binulingan.
10. Binatik (spotted). Bearded, light red, small grain.
11. Binakroy. Short beard, light color, small grain.
12. Binatad (hard). Bearded, light brown, small grain.
13. Binato (stone). Beardless, light red, round flat grain.
14. Bulilsing. Bearded, brown, small grain.
15. Bulic (gray). Bearded, red, small grain.
16. Buncol.

17. Contenido (plentiful). Bearded, light purple, small grain.
18. Caviteña (Cavite). Beardless, light red, small grain.
19. Casine. Bearded, light red, small oval grain.
20. Calibo (Calivo). Beardless, light brown, small grain.
21. Cuyap-pa.
22. Dinomero (Romero). Beardless, red, small grain.
23. Diquet Uban.
24. Diquet Bulilising.
25. Dinagupan (Dagupan).
26. Diquet Balakinao.
27. Diquet Daldal.
28. Enero (January). Bearded, very dark red (almost black), thin flat grains.
29. Ganado (cattle).
30. Garay-gay.
31. Inasiman (sour). Beardless, light brown, small grain.
32. Igorot. Bearded, reddish purple, small grain.
33. Inimsima or Puting Mimis (white). Beardless, red, small grain.
34. Inarupel. Beardless, light brown, flat grain.
35. Ipotibon (bird's egg). Beardless, light red, small grain.
36. Inalsa (lifted).
37. Lampacan. Bearded, light color, small grain.
38. Macan Agá (early). Beardless, light color, small grain.
39. Macan Eneng. Bearded, light, red, full grain.
40. Macaliat. Bearded, light brown, plump grain.
41. Macan Pulot (molasses). Beardless, light red, small grain.
42. Minan Duran. Bearded, light color, small grain.
43. Magsuhay (small spikes).
44. Mimes (best). Beardless, light red, small grain.
45. Sinampaga (sampaga). Beardless, light red, small grain.
46. Macan Barus. Bearded, light red, small grain.
47. Magsumpong. Bearded, light color, mixed with brownish red, small grain.
48. Mateusa (to kill). Bearded, red, light oval grain.
49. Malacca Ocho (from Malacca). Short beard, reddish color, heavy head.
50. Macan Bucaue (from Bucaue). Round, plump grain, heavy head.
51. Malagkit (sticky).
52. Macan Cumpol (bunch or cluster). Beardless, light brown, round grain.
53. Macananay-a-bi-it.
54. Manacat.
55. Macan Juana.
56. Mangasa (to hunt with dogs).
57. Macan Señora (lady Macan).
58. Minantica (oily).
59. Nasusena.
60. Principe (from Principe). Bearded, light-colored grain.
61. Paune (early). Beardless, round, plump grain, light color.
62. Palay virgin. Beardless, reddish brown, round seed-like grain.
63. Puteng pirurutong (white). Beardless, red or wine color, striped small grain.
64. Pulang pirurutong (red).
65. Piniling niña (chosen girl). Bearded, light color, round small grain.
66. Puquintan. Light red, beardless, small grain.
67. Portoc. Beardless, round plump grain, light brown.

68. Payus. Bearded, light small grain.
69. Piniling babay (chosen woman). Beardless, very light, round, flat grain.
70. Quinauayan (bamboo). Beardless, light colored, flat grain.
71. Quinastilla (Spanish or white rice). Bearded, light brown, small grain.
72. Quinatuday. Bearded, light color, round plump grain.
73. Quinandelaria.
74. Quinamias (camias). Bearded, light red, oval grain, heavy head.
75. Sinan Felipe (Felipe). Bearded, light brown, round grain.
76. Sinan Jose (Jose). Bearded, brownish red, small grain.
77. Sinablay (drooping). Bearded, very dark red, small flat grain.
78. Sinaging (banana).
79. Sinantol (santol). Bearded, light small grain.
80. Siliquidquid. Bearded, light small grain.
81. Seda (silk). Bearded, brownish red, thin flat grain, smooth head.
82. Sagat. Bearded, light red, small grain.
83. Salumanay. Dark brown beard, long, light, oval grain.
84. Sinampaga (sampaga). Beardless, light red, small grain.
85. Sinampablo (San Pablo). Beardless, light red, small grain.
86. Sinampalian.
87. Sinagat.
88. Sinamporin.
89. Sinampiro (San Pedro).
90. Tinalahib (talahib).
91. Tui. (Name of a tree).

The usual time of planting is July or August. "Alamang" and "macan aga" are planted as early as May; "quinamias" and "calibo" in June.

Average number of stalks in one stool ranges from 5 to 28.

The number of grains on one head ranges from 70 to 405 (405 "binandera" in Licab).

The yield per hectare varies from 10 to 120 cavans; "macan bocaue" and "binatad" yielding as high as the latter figure. Amount raised: "Macan," San Isidro 8,000, Jaen 25,000, Cabiao 14,000, Gapan 45,000 cavans; "binatad," Jaen 25,000, Gapan 10,000 cavans; "bocaue," Gapan 30,000 cavans. The market price on January 1, 1908, ranged from ₱1.50 to ₱5. "Mimis," "macan," and "binatad" bringing the highest prices.

RICE CONDITIONS IN BATAAN AND PAMPANGA.

By José Rivera, Jr.,

Agricultural Assistant, Bureau of Agriculture.

Bataan and Pampanga are largely agricultural provinces, having for their principal crops rice, sugar cane, and corn. This would have been a banner year for rice in these provinces had it not been for the unusually late and excessive rain storms, which caused considerable damage on the plantations. In some cases the loss amounted to 50, or even 60 per cent of the crop. Often fields had the appearance of a veritable lake rather than a growing rice field, though in several instances the crops were matured, or nearly so. To avert any such occurrence, something must be done to improve the lands, and I am of the opinion that a good system of drainage would do much to prevent the recurrence of such flooding.

There are still large tracts of uncultivated lands in both of these provinces, especially in Bataan. This fact is due mainly to the lack of farm animals. But I believe that with a little more perseverance much of this waste land—which it is be regretted is mostly in cogon—could be made a valuable addition to the already rich and fertile agricultural fields.

As the agricultural conditions and the needs of the people of these two provinces differ I shall now consider them separately.

BATAAN.

Bataan is a very mountainous province with a soil well adapted to rice and sugar cane. It is rather poor in comparison with the other provinces visited, and the roads are badly kept.

ORION.

The principal crops in this municipality are rice, corn, sugar cane, pineapple, and coconuts, in the order named. The rice this year was damaged by the storm which swept the province about the first of last October. The rice fields are practically free from leaf diseases, although there is a worm which attacks the straw. It is greenish-white in color, about the size of a pencil lead, possibly a little smaller, and about one-eighth of an inch long. They are usually found in the last node of the straw, and prevent the head from filling. The plants affected are easily

distinguished from the rest by the whiteness and lightness of the heads, which are called "Uban," meaning gray-headed. Very few fields, however, were infected with these worms.

Mice, bats, and birds (mayas) have not done much damage this year. The farmers of this locality have not, so far as I could learn, found any satisfactory way of eradicating or combating these enemies. The majority of the people devote most of their time to fishing, and but little to agriculture, which is a rather lamentable fact, as farming is much more remunerative than fishing.

BALANGA.

The capital of the province has rice, sugar cane, and corn for its principal crops. Rice this year was damaged to the extent of about 20 per cent by too much water in the fields. The disease known as "Uban" is also found here. This disease as explained above, is due to worms which attack the straw. The average yield of rice per cavan of seed is from 35 to 40 cavans, and at the time I visited this place a cavan of rice was selling for ₱2.70, but I was told that at one time this year the price went as high as ₱3.00.

ABUCAY.

Rice is the principal product of this municipality, with sugar cane and corn following. The condition of rice was not so good as in Balanga, Pilar, or Orion. This opinion is based upon what I have seen of their rice fields and the little information which the president of the board of health furnished me.

ORANI.

The same conditions prevail here as in the municipalities mentioned above. Corn and sugar are cultivated but they are secondary in importance to rice. Rice is easily ahead of all other crops, with "macan aga" as the favorite seed of the farmers. Under favorable conditions the maximum yield of rice is 20 to 25 cavans, with an average of 20 cavans, for each cavan of seed.

There is but little difference between the methods employed for the curing of rice here and in Orion. In Orani, instead of making tall round stacks as in Orion, the stacks are somewhat low and long. As to which of these two methods is the better it is difficult to say, although the low stacks are perhaps easier to make.

DINALUPIHAN.

More than any other place visited in this province, this town depends upon the products of the soil for its subsistence. This municipality is recognized throughout the entire province as the granary of Bataan, there being more rice fields than in any other municipality. Dinalupihan supplies nearly the whole province with rice.

The method of harvesting rice is the same as that employed in the other municipalities of the province; that is, by means of a sickle. The harvesters if men are paid 50 centavos a day, and if women 30 centavos, in addition to which they are given two meals a day. The rice would have been excellent this year but for the late rains, which were very disastrous to the growing crops. Consequently, the harvest will in all probability be only normal, although a large yield was expected; fully one-tenth of the area planted to rice was totally destroyed, and the rest more or less damaged.

The average yield here is 30 cavans for each cavan of seed, a cavan being valued at ₱2.50.

PAMPANGA.

Pampanga as a whole, unlike the Province of Bataan, has sugar cane for its principal crop, with rice only second in importance. The agricultural conditions are also far more advanced than those in Bataan. This is partially explained by the fact that Pampanga is more fortunate in having the railroad, the greatest exponent of commerce, running into every nook and corner of its rich and vast agricultural fields.

FLORIDABLANCA.

This is one of the municipalities which was subjected to the ravages of storms; not less than 20 per cent of its rice crop having been destroyed thereby.

The disease known in Bataan as "uban" is called "menagak" in Pampanga, where it is present to a greater or less extent. No animals or insects have done any damage this year.

The average yield of rice for one cavan of seed is from 25 to 30 cavans, and a cavan sells for ₱2.

GUAGUA.

This is the first town I visited in Pampanga. Sugar cane is the principal product, with rice as a close second. Corn is also grown, but not in sufficient quantities for home consumption. Upon my arrival I found the rice fields all inundated, and I estimate the loss to be greater than in Floridablanca.

The birds ("mayas") bats, mice, and other animals have done but little damage to the crops.

BACOLOR.

Sugar cane and rice are the most important products. Rice suffered considerably from excessive rains. The Rio Grande de Pampanga passes through this place and when it rises the greater part of the rice fields are inundated thus causing much damage.

Of the many varieties of rice grown, "piniling belto" and "dinalaga" are most largely cultivated, being the favorite seed of the farmers. The methods employed in harvesting and curing rice are identical with those

employed in Bataan. The farmers are wide awake and seem to take a great deal of interest in the work of this Bureau. They keep abreast of the times and adapt themselves to changing conditions.

SAN FERNANDO.

This is the thrifty capital of the prosperous Province of Pampanga. Sugar cane and rice are the principal crops, although a little corn is also raised.

Rice in this locality appeared in good condition, but some fields were damaged to the extent of about 20 per cent by water. With water in the field and the plants lodged, the lower layers of the grain being submerged, there was considerable loss caused by the germination and rotting of the grains.

Most of the varieties of rice found in Bacolor are also found in San Fernando with "dinalaga" and "piniling belto" as the principal kinds grown.

ANGELES.

Of the seven municipalities in this province, Angeles is the only one where the rice fields had not suffered to any great extent from floods. The loss here is practically nothing as compared with the other municipalities, which is due mainly to the geographical position of Angeles, it being situated on high land.

Here the rice crop is mostly dependent upon the rain for water, although irrigated fields are to be found near the town and close to the hills, where they utilize the water coming down from the mountain streams.

Three methods of rice planting are practiced in Angeles, as follows: Scattering or sowing broadcast, drilling, and transplanting. The latter method it is claimed gives the best results. They also practice thinning the rice when the plant is about a meter or so high by cutting the leaf stalks and using then as feed for carabaos. They stated that in this way a better yield is secured than when thinning is not practiced.

A few farmers practice the three years rotation of crops by using three varieties of rice. For instance, planting "piniling belto" the first year, "dinalaga" the second year, "lawa" the third year, and "piniling belto" again the fourth year. Those farmers who were using this method declared that the better results were invariably obtained thereby than by continually cultivating one variety, as is done all over the country.

MEXICO.

The principal crops are sugar cane and rice. The rice fields of this municipality suffered more by inundations than all others visited, and the loss is calculated at about 50 per cent of the crop. In this locality I saw people fishing their rice from the water and mud to save it, but of course this rice even after it is dried loses its good cooking and food

qualities. The town greatly needs a good system of drainage. This fact is recognized by the farmers, so much so that most of then have offered to work gratuitously if the government will send then competent engineers to direct the work.

Under normal conditions, the average yield of rice for each cavan of seed is from 20 to 25 cavans, the usual price being ₱2.10 per cavan.

MABALACAT.

The principal crops in this municipality are sugar cane, rice, and corn, in the order given. The rice here suffered damage by water to the amount of from 20 to 25 per cent of the crop. The average yield of rice for each cavan of seed is from 15 to 20 cavans, and a cavan sells at ₱1.75.

The farmers here practice two methods of planting rice, scattering or sowing broadcast and transplanting, the latter giving the best results. A system of rotation as practiced in Angeles is also followed here.

The kind of rice most favored by the farmers of this place is the "macan piña" with "matavia" taking the second place. Besides these two, "lawa," "dinalaga," "piniling belto" and "maiqui" (which means with tail, so called on account of its long awn or beard) are also cultivated.

The farm wage paid here is 50 centavos to men and 40 centavos to women, with two meals a day.

The following varieties of rice have thus far been reported from the towns named in Bataan and Pampanga:

Towns.	Varieties, in order of importance.	Highland (H) or lowland (L).	Glutinous (G) or non-glutinous (NG).	Bearded (B) or not bearded (NB).	Color of cuticle.	Days to maturity.	
						From sowing.	From transplanting.
BATAAN.							
Abucay	Macan	H	NG	NB	White	150	130
	Lacatan	L	NG	NB	Red	90	
	In achupal	L	NG	NB	White	180	150
	Inaplaya	L	NG	NB	Red	150	120
	Bulacsac	H	NG	NB	White	150	
	Guinulong	H	NG	NB	Red	150	
Dinalupihan	Macan	L	NG	NB	White	150	120
	Pinursigui	H	NG	NB	Red	90	60
PAMPANGA.							
Macabebe	Pinursigui	L	NG	NB	do	120	80
	Lacatan	L	G	NB	do	180	150
	Calibo	L	NG	NB	White	120	
	Eput-ebun	L	NG	NB	do	120	90
Masantol	Pinursigui	L	NG	NB	do	90	
	Calibo	L	NG	NB	Red	100	
	Lacatan	L	G	NB	do	100	
	Inanis	L	NG	NB	White	100	
San Simon	Macan	H	G	NB	do	210	150
	Macan, San Miguel.	H	G	NB	do	210	150
	Macan, Lamue	H	G	NB	do	210	150
	Eput-ebun	H	G	NB	do	150	
	Pinursigui	H	G	NB	do	90	
	Pauni	H	G	NB	do	105	
	Casubung	H	G	NB	do	150	

EXTRACTS FROM THE REPORT OF MR. R. DERRY, CO-COMMISSIONER FOR MALAYA, ON THE INTERNATIONAL RUBBER AND ALLIED TRADES EXHIBITION HELD IN LONDON, SEPTEMBER 14 TO 26, 1908.[1]

PART I.

The First International Rubber Exhibition was convened with the object of demonstrating the present position of a comparatively new industry and of furnishing an opportunity for its further development by an interchange of ideas between all concerned.

To comprehend the present position of the industry it is well to remember that in 1827, or eighty years ago, the world's demand for raw rubber amounted to fifty tons, and for the year 1907–8 it is computed at 65,000 tons, valued approximately at £20,000,000. As a matter of fact, this enormous industry has been developed during the last fifty years or less, for although there has been a small demand for raw rubber since 1827, real commercial enterprise did not begin until the discovery and perfecting of the process of vulcanization by Goodyear, Hancock, and Parkes about thirty years later. Since that time the demand for raw rubber has annually increased, while some sources of supply have been practically exhausted, and in others the future output is not assured. It should be said, too, that the remaining areas of the world as probable sources of wild rubber are not considerable.

RUBBER-PRODUCING PLANTS.

Until the recent discovery of "guayule" all known rubber-producing plants were included in the four natural orders of *Euphorbiaceæ*, *Moraceæ*, *Apocynaceæ*, and *Asclepiadceæ*. The addition of "guayule" (*Parthenium argentatum*) and colorado rubber (*Actinella richardsonii*) introduces another order, viz, *Compositæ*. An addition to the *Asclepidaceæ* is furnished by a new introduction from Angola and Zambesi called "encanda" rubber, and described as *Raphionacme utilis*. There are five other natural orders, of which some genera are said to be lactiferous plants, but they are of theoretical interest only.

[1] From Agricultural Bulletin of the Straits and Federated Malay States, Vol. VIII, No. 2, February, 1909.

The arrangement of the different families of commercial rubber plants is as follows:

I. EUPHORBIACEÆ.—*Hevea, Manihot, Micrandra, Sapium.*

II. MORACEÆ.—*Ficus, Castilloa.*

III. APOCYNACEÆ.—*Landolphia, Funtumia, Carpodinus, Clitandra, Tabernaemontana, Mascarenhasia, Hancornia, Forsteronia, Willughbeia, Urceola, Leuconotis, Melodinus, Parameria, Chonemorpha, Chilocarpus, Dyera, Alstonia.*

IV. ASCLEPIADACEÆ.—*Cryptostegia, Raphionacme.*

V. COMPOSITÆ.—*Parthenium, Actinella.*

RUBBER SOURCES.

The world's output of raw rubber is stated to be as follows:

	Tons.
South America (including Mexico)	43,000
Africa	22,000
Eastern and Indo-Malaya	500
Total	65,000

All of this output is forest or wild rubber. In South America the bulk of the suppy is obtained from Para rubber (*Hevea braziliensis*). Other varieties are, Ceara rubber (*Manihot glaziovii* and *Manihot* sp.), caucho ball, or ule in Mexico (*Castilloa elastica*), Mangabeira rubber (*Hancornia speciosa*), and recently from Mexico "guayule" (*Parthenium argentatum*). The following genera also produce valuable rubber, which is probably mixed with Para: *Micranda, Sapium,* and *Forsteronia.*

The amount of rubber exported from South America during the last fiscal year is said to be 36,000 tons (of this 7,500 tons is caucho ball) by way of Brazil, and about 5,000 tons from Mexico, most of which is said to be "guayule," one-fourth is exported to Europe, principally Germany, and the remainder to the United States.

In Africa the principal rubber-producing plants are several species of *Landolphia,* and Lagos silk rubber (*Funtumia elastica*). Others are the root rubbers *Carpodinus lanceolatus* and *Clitandra henriquesiana.* N'-Harasika rubber tree (*Mascarenhaisa elastica*). Some rubber is also obtained from *Ficus vogelii* and the genus *Tabernaemontana.*

These are widely distributed over tropical Africa. On the west coast from Senegambia, Sierra Leone, Gold Coast, Ivory Coast, Lagos, the Cameroons, Nigeria, Congo, and Gaboon, to Angloa and Benguela. On the east coast from Mozambique, Madagascar, Zanzibar, and Nyasaland to German East Africa. Rubber is also exported from Unganda in the interior. The following trade names indicate the places from which African rubbers are exported: Madagascar niggers, Mozambique ball, Hausa thimbles, Niger cake, Ivory Coast lump, Hausa tail, Benin lump, and others.

The total output of African rubber is stated to be 23,000 tons, which is said to be excessive by some authorities. Of this, 4,800 tons are supplied by the Congo State, about 1,500 tons by the Gold Coast—a considerable shrinkage from previous years—and the balance from other parts of Africa, chiefly Madagascar Mozambique, Uganda, Lagos, Angola, and the Cameroons.

Asiatic or eastern rubbers include Assam rubber—i. e., Malayan Rambong (*Ficus elastica*)—Ferip, Singarip, or Bornean rubber (*Willughbeia sps.*). Other genera are *Leuconitis, Urceola, Melodinus,* and *Parameria.* There are other rubbers, but these do not appear to be included in the usual records and are not mentioned now. At the present time the most important sources of wild rubber are Sumatra, Borneo, and possibly New Guinea. Figures showing the output are given from British India only and are placed at 200 tons.

I would, however, call attention to an important discrepancy between the figures stated to represent the output of Asiatic rubber and the actual exports. It has been ascertained that no less than 10,000 tons of jelutong (*Dyera costulata*) are used annually, which is exported via Singapore and ports to America and Germany. Jelutong is a low grade rubber, but it is of as much importance as the Mexican guáyule; indeed, there is strong inquiry for it and I can only suppose the omission occurs because none of the rubber is used in Great Britain.

If, therefore, jelutong is added to the estimated output of wild rubber, the grand total would be 75,000, instead of 65,000 tons.

It should be remarked that this output of 65,000 to 75,000 tons is not only the world's demand but also the world's supply of wild rubber, and at the time of writing the former exceeds the latter, especially for fine grades of rubber, but a change is at hand; already, during the last fiscal year, 1,000 tons of cultivated rubber have been marketed; rubber cultivation is being attempted in the tropics all over the world; the annual output of rubber from plantations in, and coming into, bearing is certain to increase enormously; and a brief review of the economic situation with the aid of observations made at the exhibition may be opportune.

COMMERCIAL RUBBER.

At the exhibition there were thirty countries represented and samples of nearly all commercial rubbers were exhibited for comparison or study. The first impression that would be formed by even a casual inspection was the preponderance of Para over all other rubbers. There could have been an interesting exhibition of Para rubber only, and without it an equally disappointing one. It is, however, very important that the possibilities of all commercial rubbers be examined, and in this review I will leave Para rubber for the last.

I. EUPHORBIACEÆ.

Manihot glaziovii (Ceara rubber) was only sparingly exhibited but the few perfect biscuits and small samples in the Ceylon and West Indies sections received much attention. This species was obtained from the Province of Ceara by Mr. Cross and distributed to the West Indies, India, Ceylon, Africa, and the Straits about the year 1877. Until quite recently all reports in respect to yield were disappointing and its introduction being contemporary with that of *Hevea braziliensis* very little progress had been made. From Africa, the West Indies, and several different countries in the East, reports agree as to luxuriant growth, but a scantly yield of latex. This may be due to excessive humidity or to variety, as there are some favorable reports from southern India, and as there are different varieties of *Manihot,* it may be that most of the Eastern species are of a poor strain, or as said before, that the climate is too damp. Future trials in Malaya would stand the best chance of success if planted at Port Dickson, or the northern part of Province Wellesley.

It should not be forgetten that this rubber when well prepared obtains the highest price. It grows best in dry tropical countries on the poorest soils and if it can be successfully cultivated it will have to be reckoned with as a rubber of the finest grade.

Formerly Ceara rubber appeared on the market in the form of "scrap," being coagulated on the trees by natural heat in tears or strips and subsequently collected and rolled into balls. In this scrappy and impure condition its value naturally depreciated, but the rubber now prepared in India, Ceylon, and German East Africa is valued at about the same as the best plantation Para. The Imperial Institute published the analyses of some samples recently examined. I quote the highest and lowest:

	Highest (per cent).	Lowest (per cent).
Caoutchouc	85.6	82.8
Resin	6.3	8.5
Proteids	6.2	9.4
Ash	1.9	2.3

Other species, perhaps more valuable, are—

Manicoba rubber (*Manihot dichotoma*) and *Manihot piauhyensis* of Brazil. It is believed to be a fine grade of rubber, but native collectors mix the latex with that of *Hevea* and consequently very little is known of its actual value.

Sapium is a genus extending over all the rubber growing districts of Brazil, Colombia, Venezuela, and British Guiana. The latex of a few species in Brazil is used for mixing with *Hevea*. *Sapium biglandulosum*, the most common species in Brazil, has been reported on at different times

and its rejection as a commercial rubber has led to some confusion as to the value of other species; particularly *Sapium jenmani* (touckpong), a native of Guiana and extending to Venezuela and north Brazil. This plant supplies a high grade rubber, but a chemical analysis had not been published at the time of the exhibition. It is anticipated that its cultivation will be taken up extensively in different parts of the West Indies. However, the seedling plants, compared with the robust *S. biglandulosum*, did not impress me as possessing the constitution of a vigorous growing tree for plantations. Other species of value are *S. utile* (palo de leche) from Ecuador and Peru, and *S. verum* (virgin caucho) from Colombia. Price variable, about 3 shillings 2 pence against 4 shillings 6 pence for fine, hard Para.

II. MORACEÆ.

Ficus is an extensive Old World genus, but only a few of the many species produce rubber of commercial value. *Ficus elastica* (Rambong or Assam rubber) is the most valuable species and is now cultivated in India, Ceylon, British Malaya, Java, and Sumatra, but not so extensively as was expected a few years ago, possibly due to the higher price obtained for Para rubber and its more regular yield of latex. This *Ficus* is one of the earliest known of Asiatic rubbers and was first brought to notice by Dr. Roxburgh over a century ago. In a wild state the plant is epiphytic, growing on other trees or rocks, and appears as a small crown or crest of short branches on long rambling aërial roots. Under cultivation it is grown as an arborescent tree and develops stout lateral branches and a consequent larger area of bark for tapping. On some estates in the Netherlands Indies the aërial roots are pruned off and the tree is cultivated as a standard—i. e., a bushy crown and large main stem. Its habitat extends from the Sikkim Himalaya, Assam, and bordering States, to Upper Burmah, the Malay Peninsula, and Sumatra. In habit there are marked varietal types of this species:

(*a*) The Assam type has a straiggling habit with pale green, rather narrow leaves and the yield of latex is only moderate.

(*b*) The Malayan type is of compact habit with larger green leaves (on young trees) and brillant colored stipules. The yield of latex is considerable, provided the period of recuperation is a lengthy one.

(*c*) The Sumatra type resembles the Malayan plant, but is more ornamental in form. The leaves are deep, shining green and more elliptic, and like its Malayan congener the yield of latex is large if not tapped too frequently.

Formerly Rambong rubber appeared on the market in the scrap form only, as the bulk of it does at the present time, but other forms of preparation are forthcoming and improved prices are being obtained. With old trees there is a short flow of latex, followed by slower exudation which coagulates by natural heat in tears and strips on the incisions

made on the tree. This if removed as soon as agglutinated may be boiled and prepared in the form of a biscuit or sheet. On younger trees, there is comparatively a better flow of latex and this can be treated with liquid ammonia, when the particles of caoutchouc, after stirring, gradually separate into a thin layer and can then be skimmed, washed, rolled into biscuits, or passed through a crepe machine and dried.

A long period of rest is necessary, owing to the thick latex peculiar to this tree and the more concentrated form in which the caoutchouc is obtained; but despite this drawback the average yield per tree is probably higher than that of Para rubber and, considering the immunity of the tree from disease, its simple culture and light cost of working, as well as the fine grade of rubber when well prepared, Rambong has many claims for more extended cultivation in British Malaya. At the exhibition the Netherlands' section included sheets, cakes, and in bulk, crude Rambong balls, or rolled scrap pickings bound up with Rambong ribbons obtained by slicing pressed scrap. In the Malayan section Rambong was exhibited in crepe form, but only a few estates were represented. The low price of 3 shillings 8 pence against 4 shillings 6 pence for "fine hard Para" is stated to be due to the small quantity of plantation Rambong on the market. An analysis of well-prepared Rambong compares favorably with that of the best Para, and there is very little difference in respect to caoutchouc but the percentage of resin and proteids is slightly higher.

In Java the Netherlands' Government has rubber plantations amounting to nearly 15,000 acres, mostly of Rambong.

In Africa moderate grade rubber is obtained from *Ficus vogelii.*

Castilloa elastic (ule, Central American rubber, or caucho ball) is a native of Central America, including Mexico, Guatemala, Nicaragua, Panama, Honduras, and parts of Colombia, and when fully grown is the largest of all rubber trees. Owing to excessive tapping, and very often felling, most of the large indigenous trees have been exterminated, but a considerable area in Mexico, estimated at 100,000 acres, is already under cultivation, a factor which must not be lost sight of in considering the future prospects of the rubber market. In the West Indies, too, cultivated *Castilloa* is a rubber which it is expected will be heard of in the future. The yield of rubber from *Castilloa* is high, being about the same as Para and varies from 2 to 16 pounds according to the size and age of the tree. The latex has an acid reaction and can not be cured by smoking. It is generally coagulated by boiling, but sometimes by the addition of alum, salt, or a decoction made from the stems of the moon-flower. A much improved process for coagulating the latex is now used. With the aid of a machine rotating about 6,000 times per minute the particles of caoutchouc are quickly separated into a white layer and can then be taken off and dried. It is expected that all of

the future plantation *Castilloa* will be prepared by centrifugalizing and a better marketable rubber will thus be obtained, as in this way the high percentage of resin can be disposed of. The nerve or tensile strength of *Castilloa* is not so good as that of Para, and the rubber has never obtained so high a price. At the time of writing, caucho ball, dirty scrappy *Castilloa,* is quoted at 3 shillings 10 pence against 5 shillings 4½ pence for fine hard Para.

The attempted cultivation of this species in British Malaya can only be described as a failure.

III. APOCYNACEÆ.

The genus *Landolphia* include several valuable species, the most important being *L. florida* (*Vahea comorensis*), *L. ovariensis* (white rubber vine), and *L. Kirkii* from east tropical Africa.

Other species are: *L. Thollonii,* southern Congo, *L. Buchananii,* east tropical Africa, *L. petersiana,* tropical Africa, *L. senegalensis, L. tomentosa,* west coast, and *L. madagascarensis,* east coast. The *Landophias* possibly occur all over tropical Africa, including Madagascar and Zanzibar. All are climbing plants resembling the Malayan *Willughbeias* and require a post or tree to support the vine or liane, and consequently are not of easy cultivation. The supply of rubber from indigenous plants has considerably diminished owing to excessive and uncontrolled tapping. In German East Africa more control is exercised and worked areas are stated to be closed for a period of three or four years after tapping. Plantations, too, are being formed at the botanic stations of the British African possessions but it is doubtful if these can do more than preserve seeds.

So far, only dirty, badly prepared rubber has been put on the market from Africa and some of this loses as much as 50 per cent in weight when washed. In some parts of Africa the native collectors allow the latex to flow on the ground, where some of the moisture is absorbed or evaporated, and when coagulated the rubber is afterwards gathered regardless of dirt. In other parts the negroes smear the latex over their bodies and when sufficiently agglutinated tear it off and roll it into balls. From the Congo some *Landolphia* rubber is obtained by diluting the latex with water and as the caoutchouc separates it is skimmed off and kneaded into various forms, while at other places on the west coast rubber is prepared by treating the latex with salt water, lime juice, or boiling effusions of certain plants, notably *Bauhinia reticulata.* As may be inferred, much of such rubber is of a very poor grade and obtains only a low price. Some of the best prepared Mozambique ball, probably *Landolphia kirkii,* reached 4 shillings 9½ pence against 5 shillings 4 pence for fine hard Para.

Funtumia elastica (Lagos silk rubber) was first reported from Lagos in 1894. It is widely distributed on the west coast and is also abundant

in Uganda. Unlike the climbing *Landolphias,* to which *Funtumia* is allied, this species forms a medium sized tree and admits of easy cultivation. Its discovery has compensated the African output for the loss of *Landolphia* rubbers through excessive tapping. Some nice samples of clean *Funtumia* were exhibited from the Gold Coast and Uganda, and improved methods of preparation are being carried out in these possessions, but much of the trade rubber is prepared by boiling, a method open to many objections; and the market price of such rubber is about 2 shillings 8 pence, with fine hard Para at 4 shillings 6½ pence.

Carpodinus lanceolatus and *Clitandra henriquesiana* are the so-called rout rubbers. These are semiherbaceous plants found in the Congo and as far as Portuguese southwest Africa and northwest Rhodesia. These little plants grow from 1 to 2 feet high and contain some latex in the leaves and stems, but principally in the creeping underground rhizome. To obtain this rubber the whole plant is removed, the roots are cut into lengths, dried, and afterwards macerated in water for some days, when the caoutchouc can be beaten out, but as the resulting rubber is mixed with particles of the plant such impurities detract from its market value.

Its growth is probably too slow for remunerative cultivation, as it does not appear to be utilized in any one of the many plantations now being formed in many parts of Africa.

Tabernaemontana crassa is a dwarf-growing tree native of Sierra Leone and supplies the rubber from that country and the Gold Coast. This plant is grown in the botanic gardens of the Straits and at Kuala Kangsar, Perak, where it attains the dimensions of a moderate sized tree. The yield of latex is scanty and the percentage of caoutchouc low. Another species of *Tabernaemontana* supplied much of the rubber exported from Madagascar after the *Landolphias* had been exhausted but this, too, in turn, soon largely diminished owing to excessive tapping. A third rubber-producing species, *T. Thustoni,* a moderate sized tree, grows in Fiji and produces some rubber.

Mascarenhasia elastica (N'Harasika or Mgoa rubber tree) a native of British and Portuguese East Africa supplies an addition to the rubber exported from these countries. The annual value of the rubber (including *Landolphia kirkii*) exported from British East Africa averages £20,000. There are a few specimens of this species in the Singapore Botanic Gardens.

Hancornia speciosa (Mangabeira rubber) is a slender-growing tree fairly abundant over nearly all Brazil from Pernambuco to Peru. Unlike the *Haveas* it grows in poor soils and up to an elevation of 5,000 feet. In some parts of Brazil the latex is diluted with water and as the caoutchouc coagulates it is skimmed and dried. At Pernambuco coagulation is obtained by the addition of alum, and in Peru, of soapsuds. In other parts common salt is used for clotting the latex, but with any

of these methods Mangabeira is imperfectly and, in fact, only partially coagulated and frequently ferments giving off an offensive odor; there is also a heavey loss in weight, from 40 to 50 per cent, in washing. There appears to be a fair supply of this rubber, valued at 3 shillings 1½ pence as against 5 shillings 4 pence for standard market grade. No doubt it would be much improved if coagulated by centrifugalizing, as is done with *Castilloa.*

Forsteronia gracilis is a climbing plant, native of British Guinea, north Brazil, and Venezuela. The rubber reported has been of fine grade and the cultivation of the plant in the West Indies is expected. I would, however, again remark that the cultivation of climbing rubbers has not so far met with success. Another species (*F. floribunda*) is found in Jamaica and is also said to produce a fine grade of rubber.

The Indo-Malayan *Apocynaceæ* are well represented by the genus *Willughbeia* (getah gerip, singarip, getah susu, and many other names according to locality). The best rubber is obtained from *W. firma,* formerly common in British Malaya, Sumatra, and Borneo. The rubber is obtained by ringing the liane and the latex drops into folded palm leaves, or native cups, and is coagulated with alum or salt when slightly heated. In this form the rubber is of poor quality, very wet, and loses from 40 to 50 per cent in washing; at the present time it is worth about 2 shillings 9 pence. What is now supplied comes principally from Borneo but the output from all sources has been largely diminished. A few years ago in Malaca and in the Federated Malay States getah gerip or *Willughbeia,* of sorts, was used by the natives for adulterating getah percha and getah taban.

Other species are *W. coviacea, W. tenuiflora,* and *W. flavescens,* the Borneo rubber being a mixture of any or all of these, and probably other rubber vines too. None of these rubber vines have been successfully cultivated. In the wild state the lianes may reach 4 to 6 inches in diameter but under cultivation no such dimensions can be obtained, and even if satisfactory growth could be obtained, I am confident that at the present time such cultivation could not be made remunerative and the superior claim of arborescent trees over climbing plants, for economic working, will commend itself to all parties.

Urceola elastica (getah gerip tembaga and getah gerip merah) is also a climbing plant. It does not grow in Borneo and is now rare in the Malay Peninsula. This was the first rubber plant brought to notice from any part of Asia by Mr. J. Howson, a surgeon of Penang, in 1798. The rubber is of fair grade and of the same quality as *Willughbeia firma.*

Leuconotis eugeniaefolius (akar getah sundi) another climbing plant occurs in the Malay Peninsula, Sumatra, and Borneo. It produce a fair grade of rubber but is now rare. There are two or three species.

Melodinus orientalis is also a Peninsula climbing plant of only little value. It was formerly used for adulterating the latex of *Willughbeia* and *Leuconotis*.

Parameria glandulifera (akar gerip putch) and another apocynaceous climber, *Chonemorphs macrophylla,* have a wide Eastern distribution and some repute as rubber plants. A sample of rubber prepared from *Chilocarpus costatus* was exhibited in the Netherlands section from Sumatra.

Dyera costulata (getah jelutong) is a well-known tree in all parts of Malaya, but has only received attention for its commercial value during the last few years. It is a gigantic tree, much larger than *Castilloa.* The writer remembers a tree in Malacca nearly 200 feet high, which at a man's height from the ground required five men with outstretched arms to span its circumference. Locally, the wood although light, is less brittle than *Havea* or *Castilloa* and is used for several bazaar purposes, and by Chinese for wooden sandals. Hitherto, native collectors obtained small supplies for adulterating better grade rubbers and for making a local birdlime. Although the latex contains only a small percentage of caoutchouc, about 5 per cent, a large tree is capable of yielding a considerable volume of such latex; reports place the weight at 2 to 3 pikuls. As previously stated, about 10,000 tons of this rubber are exported annually, principally from Borneo and Sumatra. The bark is of medium thickness, soft, and very easy to excise, and new bark is formed much quicker than with any other rubber tree, hence with ordinary skill and discretion there is no reason why a single tree should be lost through over tapping.

The latex is coagulated by natural heat and evaporation, pressed into balls and cakes, and preserved with the addition of formalin. In this form it has the appearance of a white, spongy cheese and a pungent odor.

It is a huge mistake to suppose that these low-grade rubbers are only used for cheap varnishes or pasting wall papers. I quote from Dr. Wermer Eschs' notes on manufactured India rubber at the recent exhibition. "To-day Para rubber has had to be abandoned so far as the manufacture of a considerable part of our India rubber goods is concerned, and its place has been taken by cheaper rubbers. We have to learn to renounce to a great extent the easy workable Para rubber, and to condescend to take up the wearisome study of the methods of treatment of "guayule." Many have been unsuccessful herein on account of inability to fit themselves into the new conditions and surroundings."

This *Dyera* (jelutong) rubber is similarly used, so I was informed, in Germany, i. e., for compoundings and fillings, as with low-priced goods the best rubbers are prohibited and with some other goods it is claimed that the article is improved by such addition or adulteration.

Owing to its poor grade and low price obtained for jelutong rubber, its cultivation does not attract private enterprise, but considering the demand and the simplicity of conserving or fostering the present trees in the peninsula, the importance of this rubber is worthy of attention.

In Malaya jelutong grows readily everywhere from naturally sown seeds. It may be profitable for reforesting certain areas if seeds can be obtained. These are produced on old, tall trees and are difficult to collect, as when the capsule bursts the seeds, which are flat and thin, are apt to be blown away.

Alstonia scholaris (getah pulai) has a wide distribution from India throughout the tropics of the East. The rubber is not so easily prepared as that of jelutong, but considering the abundance of this tree, particularly in Sumatra, it will most probably soon be in demand. It is fairly common in the Malay Peninsula and is a much smaller tree than *Dyera costulata* but grows from self-sown seeds almost everywhere.

IV. ASCLEPIADACEÆ.

Cryptostegia prandiflora is a well-known plant from Madagascar and is grown in nearly all botanic gardens for its handsome flowers. The rubber is reported as being of fair grade but the cost of collecting it is prohibitive, as the plant is of small dimensions—a bush or low limber.

Raphionacme utilis (Encanda rubber) is a recent discovery from Angola. It differs from all other known rubber plants and is a herbaceous stemless plant with a tuberous shaped root, a tuber like a small garden turnip with a few stemless leaves. So far as is known at the present time the rubber is difficult to separate and prepare. Some laboratory samples show a very high return of caoutchouc but the time and expense of eliminating resins and other matter is considerable. Nearly all the African tubers imply a group of plants peculiar to arid regions. The tuber contains a viscid fluid or storage of sap enabling the plant to survive long periods, two or three years, of drought, and I surmise that it is the difficulty of separating the latex from the contaminating sap of the rubber which detracts from its successful preparation. It is a fascinating plant and furnishes a high grade of rubber, but considering the probable expense of preparation, the uncertainty of a mature crop, and its desert origin, there is little likelihood of its ever reaching the market as plantation rubber.

V. COMPOSITÆ.

Parthenium argentatum (guayule rubber) is a recent introduction from Mexico and Central America. A low herbaceous bush of slow growth, but found wild over large areas of Central America. Although a low-grade rubber it has excited considerable interest in the rubber trade as a cheap adulterant and substitute for better rubbers—thanks

to the advance made in the treatment of all rubbers by chemists and manufacturers—and has brought into use many lines of cheap rubber goods which otherwise would not have been saleable, owing to the high cost of the raw product. The rubber is obtained from all parts of the plat, the bush is cut down, dried and soaked, after which the caoutchouc is beaten out. However, as the whole plant is used, and requires about twelve years to attain a heighth of 2 or 3 feet, its cultivation can not be made remunerative.

It has been suggested that the plants be grown from cuttings or layers; if this could be done, which is very doubtful, there would be a saving of time; but even so, the cost of production would be very high for so low a grade of rubber, and not having any means of quick and successful reproduction, the present wild supply is reported to be approaching exhaustion.

Actinella richardsonii (colorado rubber) is also a composite resembling the "guayule" plant and rubber, but not so abundant.

EUPHORBIACEÆ.

Of the genus *Hevea* (Para rubber) there are said to be fourteen lactiferous species, the most valuable being *H. braziliensis*. This genus has its headquarters in Brazil, but extends to the adjoining territories of Bolivia, Peru, Venezuela, and Guiana. It is the most abundant and best known of all rubber-yielding plants and the prepared product, fine hard Para, is the standard rubber on the market to-day.

With the development of manufactured rubber fears were expressed of the probable exhaustion of wild sources of supply, and the desirability of introducing the Brazilian Para tree to British territory in the tropics, where the natural conditions of climate follow those of Brazil, was first given effect in 1872 when Sir Clements-Markham obtained seeds for the Royal Gardens at Kew. These were taken out to India and in 1875 Mr. Wickham was commissioned to obtain more seeds for the British Indian government. He brought 70,000 seeds to the Kew Gardens and as the climate of India was not considered satisfactory about 1,900 seedling plants were sent to Ceylon. About the same time Mr. Cross was sent to South America for Para plants in case the seeds failed. Mr. Cross brought to Kew living plants and seeds of Ceara rubber and *Castilloa elastica*. The Para plants were distributed to Ceylon, Singapore, and the West Indies. Under experimental cultivation at the botanic gardens of Ceylon and Singapore the trees thrived, but very little progress had been made by planters until the year 1899, when, owing to the collapse of coffee cultivation and the increased price of raw rubber, the prospect of plantation rubber received serious general attention, and at the present time it is estimated that in these two countries alone there are about 360,000 acres under

cultivation, or approximately 60,000,000 plants, raised from the original stock brought by Messrs. Wickham and Cross, and indeed all plantations of Para rubber in the Netherlands, Borneo, Samoa, Burmah, Africa, and the West Indies, are the progeny of plants supplied by the botanic gardens of Ceylon and Singapore.

The price of the best Para rubber advanced from 2 shillings in 1861 to 4 shillings 10 pence in 1882, and fell again to 2 shillings 2 pence three years later. Since then, although there have been fluctuations, the price has gradually advanced, and in 1899 reached 4 shillings 8 pence. About this time (1880–1890) Brazilian collectors discovered that their country was richer in indigenous trees than had been anticipated. All the main tributaries of the Amazon, as far as Bolivia and Peru, offered better collecting ground than the mouths of the Amazon (island rubber), and the port of Para was superseded by the port of Manaos, the capital town of the State of the Amazonas, about 1,000 miles up the Amazon, which is navigable for ocean-going steamers, became, and is still, the largest port for rubber in the world. From Manaos 374 tons of raw rubber were exported in 1880, and 19,924 tons in 1907. Despite this large increase of output, the demand for raw rubber has steadily advanced.

This increased demand is entirely due to the improved methods used by the manufacturers and chemists during the last few years in the treatment of raw material, and a more extended knowledge of compounding, which has brought into the market many cheap goods. Writing on the "Treatment of Rubber," Dr. Torrey says of fillers and compounding: "Substances which make vulcanization take place more promptly and definitely may be added; some of them increase the strength and resilience very notably;" and again, "Compounding is not only defensible, but essential to an intelligent and legitimate application of rubber in the arts."

The rubber produced by the different species of *Hevea* in Brazil is classified, according to the districts where it is prepared, as "fina," "extra-fina," "grossa," and "sernamby," and all of this is coagulated with the aid of smoke. The latex of *Hevea* is alkaline to litmus and the smoke contains the necessary acid reaction, and it is by this process that the best rubber on the market is obtained. It is frequently insisted that the superior quality of "fine hard Para" is due to the particular smoke used, viz, that obtained from the fruit of the urueuri palm (*Attalea excelsa*), but this does not appear to be extensively used, and it is quite possible that the smoke of many other palm-nuts—e. g., coconuts—would answer equally well. The real advantage of smoking most probably lies in the method of coagulation. This was described by Dr. P. Schidrowitz as follows: "The method of smoking and drying one thin layer upon another in endless succession may, in my opinion,

be compared to the manufacture of wirewound artillery. It is well known that the strength of a gun which is built up by tightly winding wire around a core is much greafer than that of a solid cast or forged mass. A great part of the physical strength, if I may so put it, of fine Para is due, in my opinion, to this method of coagulation by concentric layers."

No doubt there are other factors than the method of coagulation which enables Brazil to market the finest grade of rubber, and I suggest that the dominant one lies in the short tapping period during the dry season, i. e., at a time when the latex contains the minimum percentage of water.

It is not claimed by manufacturers that "fine hard Para" always reaches the market in perfect condition. It is well known that the latex of several plants is used for mixing with that of *Havea brasiliensis*. I was also informed that none of the latex, whether from young or old trees, is kept separate; but it is asserted that any of these difficulties are more easily disposed of with Brazilian than with plantation rubber, where the latex of trees of different ages has been mixed.

PLANTATION RUBBER.

Plantation rubber is still in its infancy and the output compares with Brazilian rubber as follows:

Country.	1905 (tons).	1906 (tons).	1907 (tons).
Ceylon	75	147	248
Malaya	130	385	936
Brazil	34,490	38,000	36,470

It has taken Brazil fifty years to increase its output from 1,800 tons to 36,470 tons and this much may be accomplished by plantation rubber from the East within the next ten years. How far a large influx of cultivated rubber may affect the market, it is difficult to forecast. At the present time there is strong demand for raw material and an annual output of about 100,000 tons during the next decade may not do more than meet market requirements, but there are many other plantations in various parts of the world and when all come into bearing this output would be largely augmented.

But during the next decade there must be a large decrease with several wild rubbers. The African *Landolphias* like the Malayan *Willughbeias* will gradually drop out. "Guayule" is reported to be shortening, and jelutong and pulai in native hands will most probably share the fate of all the other indigenous Malayan rubbers. Whether Brazil can maintain its present output is very doubtful, as there are already signs of a decrease in exports, and Brazil is living on its capital. Un-

doubtedly *Hevea braziliensis* is a marvelously reproductive plant, but there is no record of any plant or crop which does not become exhausted when no assistance in any form is given; the well-known mangrove swamp plant reproduces itself provided seed-bearing trees are ear-marked and the period of recuperation is a long one; but such a system could not be adopted for wild rubber in competition with the plantation product, and the lower grades are almost sure to suffer when cultivated rubbers make good the shortage; I am not at all sure that fine grade Para would suffer by such competition.

RUBBER PROSPECTS.

The greatest injury that could be done to a prospective industry would be to overrate its possibilities, and although cheap production is an important and necessary factor in plantation rubber I suggest that it is a great mistake to build on it as the only or most important one.

It has yet to be proven that the present method of treating latex from plantation Para trees in British Malaya is the best or only method. It will be remembered that the process is borrowed. When Professor Biffen demonstrated the advantage of curing *Castilloa* latex by centrifugalizing he also tried *Hevea* by the same method, but the latex failed to respond to such treatment. The rotating machine was dropped, but the treatment of the latex by diluting with water still remains. There is abundant evidence that water in any form added to the latex of *Hevea* is a mistake. *Castilloa* and *Hevea* are two totally different rubbers, and I suggest that the addition of any water to *Hevea* latex sooner or later polymerises the molecule, and the result is limp rubber. I pause to mention that I was assured by the principal of one of the largest firms of continental manufacturers that different results were obtained from a ball of fine grade Para when treated in Hamburg, Harburg, and Vienna. I wonder on how many estates in the colony or Federated Malay States the water is alike. Para rubber is a highly complex compound and its best method of preparation must of necessity be a common one in order to obtain a uniform standard. It is an immense subject, but I believe, and Mr. Ridley takes the same view, that there is a solution of many of the problems of the treatment of rubber by the process of coagulating with smoke. I carefully inquired from leading manufacturers what they expected or required in plantation rubber, for the manufacturer is the master of the rubber market, and their formula was: "Latex as you get it from the tree without any chemicals, cured by smoking, as is done in Brazil."

Hitherto, owing to the omission of what might appear a trifling detail, we have failed to cure cultivated Para by smoking, but we can do it now, and are doing so, experimentally, at the Singapore Botanic Gardens, and when the novelty of a new process in this country has worn off, we hope

to be able to prepare good marketable samples. Coagulation of latex can be done on films of smoke, but it must be remembered that few plants crop similarly all through the year, and the latex at any given time may be immature as a rubber producer. Hence it by no means follows that this method can be carried on with equal success on trees of all ages and at all times of the year. And, too, the effect of continuous tapping will have to be taken into account. However, investigations are now being made along these lines and we hope to publish the results of these at a later date.

PART II.

Under the presidentship of Sir Henry A. Blake, G. C. M. G., and with careful organization, the exhibition at Olympia proved as successful as it was instructive. In the raw rubber section the countries represented, following the catalogue were: Ceylon, British Malaya, Netherlands, Brazil, Mexico, West Indies, Gold Coast, southern India, Uganda, British East Africa, and Mozambique.

RAW RUBBER.

Ceylon plantations were well represented in their section and the exhibits were nicely displayed around a tastefully designed pavilion. All the rubber was arranged in groups according to the form of preparation without reference to districts; e. g., *biscuit, sheet, crepe, block, scrap* and *worms*. Biscuit and sheet were largely exhibited and were mostly good samples. The Culloden "block" was the most favored exhibit. Ceara rubber, although well prepared, was only sparingly shown, and in fact the Ceylon section consisted almost entirely of Para rubber. This section was well decorated and furnished with a fine series of photographs and maps showing the rubber districts; literature, models of factories, samples of rubber soils and oil, tapping tools, rubber plants, etc.

Crepe.—The difference in color from pale crepe to golden yellow, and from pale to dark crepe, received a good deal of attention by interested visitors. This variation in color, however, probably due to the water, is not so remarkable as the strength of rubber from trees of the same age in different localities, although this is not so easily proved by physical tests as is the case with sheet or biscuit rubber.

Blanket.—Blanket seemed to have a tendency to slightly mold, but the Kamuning exhibit was an excellent sample, and a very fine piece also came from the Linggi Plantations.

Sheet.—Sheet rubber included some interesting exhibits, and when compared with other forms, one wonders if crepe has come to stay. The Singapore Botanic Gardens showed some sheets obtained from old trees, which were not surpassed by any plantation Para. From younger trees a sample of Bukit rajah sheet, was, I believe, the finest piece of prepared Para in the Malayan court. This sample which was of

dark color, moist texture, quite free from mold, (the only sample of sheet in this condition except Caledonia), strong and resilient, received some careful scrutiny. Unlike any other samples of sheet the Bukit rajah exhibit was rolled; the absence of mold, however, was most probably due to careful treatment rather than the method of packing. The Kamuning sheets were bold, but rather wet. Very fair sheet also came from Highlands Cicely, Golden Hope, Vallambrosa, Klanang, and Chang Koon Chang. Good pale colored sheets came from Caledonia, but they were not dry enough; and also from Sungei Choh and Trafalgar, the latter sample being good strong rubber for young trees.

Biscuit.—Biscuits, in comparison with Ceylon, were only scantily staged. The Singapore Botanic Gardens presented some fine instances of strong biscuits, and a very nice, clean, dry parcel was put up for Mr. Tan Chay Yan, of Malacca.

Block.—Block finds favor on a few estates, but of those represented all were dwarfed by the Lanadron exhibit, and possibly no plantation Para at Olympia obtained so much comment and eulogy as this rubber. Unlike Lanadron, all the other block was too dark, and did not commend itself as good commercial samples of Para.

Rambong, like Para crepe, traveled well, being free from mold, and although not largely exhibited, the clean, dry, nice looking samples from Bukit rajah, Consolidated Malay Rubber Estates, Tan Chay Yan, Malacca, and others compared most favorably with the huge lots exhibited by the Netherlands in the form of scrap balls tied with Rambong ribbons.

Literature.—In literature, Mr. Carruthers prepared an account of the industry in Malaya, and Mr. R. G. Walson a pamphlet on the Land Laws and Land Administration of the Federated Malay States, including an appendix showing the cost of rubber cultivation—this pamphlet was much in demand.

The Netherlands section was the most varied of all and although it did not exhibit Para rubber it surpassed all other sections in Rambong, and contained samples of many other Eastern rubbers. Its largest display in raw material occurred with guttas. These were exhibited in many grades and processes showing the advanced stage of the industry. Balata, from Dutch Guiana was well represented, and also gums and dammars from all parts of the Netherlands. The arrangement was tastefully carried out in large pavilions and completed with plans, maps, charts, statistics, instruments, and by far the finest series of photographs, and well printed literature.

Brazilian rubber is not attractive. It was well represented in all the different grades, and the enormous black smoked balls might convey the idea of primitive treatment, but the preparation is a traditional art handed down from the red Indians to the present day Seringueiros and requires a great deal more skill in preparation than is apparent.

The Mexican exhibits were very limited. Some fair-sized living stems of *Castilloa* were shown, and a large lot of "guayule."

From the West Indies, principally Trinidad, small samples of various rubbers were exhibited. These included *Sapium jenmani, Ficus elastica, F. Vogelii, Castilloa, Ceara,* and *Hevea.* In these islands much interest and enterprise in rubber cultivation is now being shown.

The Gold Coast, Uganda, British East Africa, Congo, and Mozambique gave a moderate representation of African rubbers. *Funtumia* and *Landolphias* were on exhibition in the form of "lump," "niggers," "sausage," "ball," "tail," etc., but rubber prepared in this way will scarcely find a market when the plantation product is more abundant. From Uganda and the Gold Coast an effort had been made to get better samples and both countries were represented by tastefully arranged sections.

Reclaimed rubber found a place in the exhibition and its use enters very largely into the trade in manufactured goods.

MANUFACTURED RUBBER.

This part of the exhibition was only moderately represented, manufacturers apparently fearing the possibility of losing or imparting trade secrets, and consequently the extent to which rubber is applied in the arts and manufactures became a matter of conjecture. From the Silvertown Rubber Works, the largest in Great Britain, a varied and interesting series of articles were exhibited, including the history of the tire trade—cycle, carriage, and motor—from the first solid tiré to the latest type of the present day. The floor of this section was paved with India rubber tiling of mosaic design. Other exhibits were samples of rubber mats and sheets fifty to sixty years old, ebonite, atletic goods, and gutta-percha cables.

In other sections, balata belting, rubber hose, rubber toys, and surgical, electrical, and engineering goods, were moderately exhibited. Only one exhibit was noticed in the direction of a new use for rubber, viz, as a substitute for tanning. A hide is treated with rubber solution which seals the interstices and renders the hide waterproof and more elastic. It is claimed that all hides so treated are improved in toughness and durability, and rubber-tanned leather would appear to have a future.

MACHINERY.

In this section was exhibited all rubber curing or preparing machines, including washing machines, blocking presses, vacuum drying presses, tools and estate requisites, a model of the Kearney high speed railway, and general estate machinery.

SCIENTIFIC SECTION.

The scientific section included laboratory apparatus and appliances for testing and analyzing rubber and rubber goods, and scientific instruments.

Literature was adequately represented by the technical journals of England, America, France, Holland, and Germany, and books dealing with every branch of the industry were abundant.

From the Royal Gardens at Kew an interesting group of rare and new rubber specimens and samples was shown, as well as two Wardian cases of Para seedlings, packed in the same way as in 1876, when the first plants of *Hevea braziliensis* were sent to the East.

CONFERENCES.

During the exhibition conferences were held by the delegates from nearly all Europeans countries and America, and a very full and complete program of the industry in all its phases was gone through.

CONCLUSION.

It is proposed to hold another exhibition in London two years hence, or in 1910, which speaks well for the success of the first International Exhibition. That success was largely if not entirely due to the development of cultivated rubber, which, as was acknowledged by the American and continental delegates, owes its position to British enterprise.

AGRICULTURE IN MANCHURIA.[1]

By Frederick D. Cloud,
Vice-Consul-General at Mukden, Manchuria.

Reports from all quarters indicate that the year 1908 has been an unusually prosperous one for Manchurian farmers. Especially is this true as regards the farmers of Shengking Province, where the crop yield is stated to be 20 per cent greater than the average for each year. The general range of prices for all farm products is also somewhat above the average, to the great delight and profit of the agricultural classes.

The government of this province has supplied me with a few statistics which I have converted into American values, enlarged from independent sources of information and arranged in a manner that may be of some value to those interested in the present and future of Manchuria as a market for foreign imports. The Manchurian Government is making a serious effort to inaugurate a system for the compilation of vital statistics of all kinds, and the following statistics are based on data furnished by its new Bureau of Statistics.

According to these figures therefore, the total population of Shengking (Fengtien) Province is 10,312,211, of which number 2,520,145 are engaged in agriculture.

Acreage under cultivation.—The total area under cultivation in the province is 4,333,333 acres, that is, there are 1.72 acres of tilled land per capita of the farming population. This of course does not mean that the average-sized farm contains only 1.72 acres, for it is well known that farming is carried on in many cases by the family or clan, which may contain from five to fifty people, who work together on one common farm, sharing the proceeds according to their own private arrangements. Such a farm might and often does comprise a hundred or more acres. No accurate data are available as to the average size of a southern Manchurian farm, but it is not far wrong to put it at 12 acres. This would make the average rural family number seven persons, which is approximately correct.

Land tenure.—Freeholding is the rule throughout Fengtien Province, but there is also considerable tenancy, the land being leased from (1) the Government, (2) Manchu princes, and (3) Lama priests. In the

[1] Extract from "Far Eastern Review, Vol. V, No. 9, Feb., 1909.

case of Government lands, the terms of lease are such as to make the tenants virtual owners, the leases being in perpetuity and the tenant having to pay only a very nominal annual rental. To this class of land belong the large tracts of "banner land" set aside in times gone by for the use and maintenance of soldiers' families. These soldiers belonged to regiments or corps known as "banner corps," hence the term "banner land." Likewise, in the case of large tracts owned by the Manchu nobility, leases are given in perpetuity, but for this class of land the tenant must pay a higher rental than for Government land. Land owned by the Lama priesthood, of which there is a considerable amount scattered throughout the province, is leased on long or short terms, and the rental paid therefor is usually the highest of that for any land. The rental for this land ranges from 6 to 15 bushels (1 bushel equals 60 pounds) of beans to the acre, which at present prices and exchange would amount to from $3.30 to $8.25 per acre.

Grain.—The following table shows the principal varieties of grain produced, together with beans, and the value and production per acre of the different crops;

Name.	Average production per acre (bushels).	Average value per acre (U. S. gold).	Average value per English bushel of 60 pounds (U. S. gold).
Kaoliang	35.3	$11.95	$0.34
Beans	31.6	17.35	0.55
Wheat	23.3	16.49	0.71
Maize (corn)	23.3	7.89	0.34
Barley	28.0	12.48	0.44
Millet	20.3	9.31	0.44

The following table indicates the approximate acreage devoted to each crop, together with the total amount of each and the approximate total values thereof:

Name.	Approximate acreage per annum.	Approximate total production, 1 bushel = 60 pounds.	Approximate total value per annum.
Kaoliang	2,166,666	76,526,643	$26,019,059
Beans	1,300,000	40,716,000	22,393,800
Millet	433,333	9,099,993	4,003,997
Wheat, Barley, Maize, Tobacco, Garden truck, etc	433,334	----------	3,900,006
Total	4,333,333	----------	56,316,862

Kaoliang.—As shown by the above table kaoliang (*Sorghum vulgare* Pers., Barbadores millet) is the most extensively grown and the most valuable crop, while the soy bean is second. Kaoliang is the food staple

of Manchuria, and bears the same relative value in the food economy of Manchurians that rice does in that of southern Chinese, or wheat in that of the Anglo-Saxon. Its uses are manifold, for besides furnishing the greater portion of the Manchurian's daily food, it supplies an alcoholic drink, thatching for houses and barns, matting for summer sheds and winter floors, wind-breaks to shield the farmer's household from the icy blasts of winter, and fuel to cook his food and warm his house. No part of the kaoliang plant is allowed to go to waste. Even the stubble and roots are carefully pulled up, dried and put away for fuel. The green blades also are gathered just before the grain is fully ripe, tied in bundles and stored for winter fodder for the donkeys and cattle.

A kaoliang field, after the crop has been harvested, is absolutely bare, there being nothing left of the vegetation to reënter the soil, and herein lies the chief, and practically the only objection to the continuous cropping of kaoliang. It requires much from the soil, but gives back nothing in return.

Soy bean.—The soy bean on the other hand is a good soil fertilizer and is extensively grown throughout the province, especially in the rich valley of the Liao River. The bean is the greatest of all export crops from Manchuria and can always be relied upon to afford the farmer ready cash. Bean oil is used throughout China for culinary purposes, being employed as lard is used in American households, while the residue after the oil has been expressed (bean cake) is exported mostly to Japan, where it is used for fertilizer. The exports of bean cake from China during 1907 amounted to 278,801 tons, and were valued at $7,300,000, United States currency, or $26.18 per ton of 2,000 pounds. During the same period there were in addition 89,124 tons of beans exported, valued at $2,560,790, or at the rate of $28.73 per ton. The total value of China's bean crop exports for the year 1907 was, therefore, $9,860,790, the greater part of which was produced in southern Manchuria.

Manchuria has a great advantage over most other agricultural regions in that the soy bean can be grown most successfully throughout the entire region, from Dalny on the south to Harbin in the north. In the United States, on the other hand, this crop is not grown with much success outside of what is known as the "cotton belt."

Millet.—The crop that ranks third in importance in the province is millet, of which there are several varieties. The best of these are known as Japanese millet, and are grown mostly for human food. It is a hardy crop and highly valued by the farmer for home consumption, but little is produced for foreign export. The annual crop is valued at about $4,000,000.

Wheat.—The wheat crop of the province has not as yet become large, but is important in view of the growing tendency among all classes to

replace the native cereal foods with wheaten cakes and bread. Thus far but little attention has been devoted to wheat growing, but with the advent of modern flour mills in Manchuria, of which there are several in operation and more being constructed, the native farmer is devoting his thought to wheat production. There is no reason, as far as soil and climate are concerned, why the Province of Shengking should not produce vastly more than enough wheat for the consumption of its entire population. At present, the native farmers know practically nothing about the proper selection of seed, or of the proper methods of cropping, harvesting, and marketing of wheat. The flour mills now in operation complain very bitterly about the Manchurian farmer's methods of harvesting and marketing his wheat. The varieties of wheat grown and the quality of the berries are very fair, and would make a good medium grade flour, if the farmer would only care for his crop in the right way. But this, apparently, he will not do, for when the wheat comes to the mill, it is either musty, or weather bleached, or foul, from which it is impossible to make a good grade of flour.

Until, therefore, the Manchurian farmer gives more intelligent attention to the seeding, harvesting, and marketing of his crop, wheat-growing will remain practically where it is, and as a crop wheat will continue to be of minor importance.

Corn (maize).—Corn is grown to some extent throughout the province, the Liao Valley, to the east of Liaoyang, affording perhaps the greatest area devoted to this crop. At present the crop is of but little value owing to defective methods of seed selection, planting and cultivation. The soil and the climate, however, of southern Manchuria, especially throughout the fertile Liao Valley, is without doubt naturally adapted to the abundant production of Indian corn. The rich alluvial soil, together with the long, hot, summer days, and warm nights, combined with copious showers of rain, constitute ideal conditions for the successful production of corn. With good seed and intelligent cultivation, there is a little doubt but that Indian corn could be made a more profitable crop to the farmer of Southern Manchuria than either kaoliang or the soy bean.

Sugar beet.—The loose, loamy soils of Manchuria are particularly well adapted to the growing in great abundance of all kinds of root crops, and are especially favorable for sugar beet production. The intense summer sunshine not only gives an abundant yield of roots, but produces a high percentage of sugar. Tests made last season at the local experiment farm showed amounts of sugar ranging from 14 to 18 per cent.

A large German beet-sugar concern recently sent an expert from Germany to look into the possibilities of the beet-sugar industry in Manchuria. According to my information, his report was most favorable, but whether or not the company contemplates the establishment of a

factory in Manchuria is unknown. At Harbin, however, such a factory is being installed.

In view of the rapidly growing demand throughout China for refined sugar, there are undoubtedly great possibilities in the beet-sugar industry in Manchuria.

Fruits.—There are but few varieties of fruit grown in the province, among which the pear, grape, and persimmon are the most valuable. The pears are hard and watery, and while they are good keepers, lasting from season to season, they are not a good table pear. Grapes are grown extensively and are the most satisfactory of all the Manchurian fruits. There is, practically, but one variety of this fruit, which resembles the California red wine grape. It is not a first-class table grape, but as it can be kept through the winter and until spring, it is, as before stated, the most satisfactory of all the Manchurian fruits. The large red persimmon is also grown and is much prized by the Chinese. Because of its abundance, it is the cheapest of all the fruits and constitutes almost the sole fruit diet of the poor classes.. Besides the fruits mentioned, there are apples, peaches, and plums of poor quality and of no great abundance. Apricots, also of inferior quality, are scatteringly grown among the hills in the southern part of the province.

The inhabitants of Manchuria are exceedingly fond of fruit, but curiously enough they seem to take little or no interest in fruit growing. If a tree grows up of its own accord and bears fruit, well and good, but the native has neither sufficient knowledge nor the disposition to care for it and cultivate it along approved lines. There is no doubt but that great quantities of excellent fruits could be grown in various parts of the province, if only intelligent methods of selection, budding, and cultivation were employed. The striking success which has followed the efforts of American missionaries in Shantung Province to improve native varieties by introducing scions from American fruits, is indeed worthy of emulation in Manchuria. The Chefoo apples, pears, and grapes are now sold in nearly every treaty port of China and command prices second only to fruits imported from America.

Live stock.—The following table shows the principal kinds of live stock of the province, the approximate number and total values of each kind, and the average value per head:

Kind.	Number.	Value.	Average value per head.
Horses	124,008	$1,525,298.40	$12.30
Cattle	62,060	588,892.00	8.20
Mules	124,242	1,780,844.00	14.33
Hogs	1,925,260	4,736,139.60	2.46
Total	2,235,574	8,551,174.00	

In addition to those mentioned, there are said to be upward of 600,000 head of sheep and goats, valued at about $1,026,148. So that the total value of the province's live stock is $9,577,322. This is indeed a nominal figure in comparison to what it might be with consistent and intelligent breeding.

It is a well-known fact that the Manchurian farmer, just as with fruits and grains, takes no pains and gives little thought to the breeding of his domestic animals. His hogs have the run of the farm, breed when they like, and subsist the best they may from kitchen and other refuse. The result is exactly what might be expected, a large-bellied, long-nosed, long-haired, loose-jointed beast, compared to which the aboriginal "razor-back" of the Ozark Mountains is a well-bred animal. Yet, as shown by the above table, the province produces annually 1,925,000 head of these animals. Scarcely any greater attention is bestowed upon the breeding of cattle or horses. Indeed, a vast majority of the horses and cattle of the province are brought down year by year from the plains of Mongolia, where the only occupation of the people is stock raising, and while the Mongolian pony is an excellent work animal, he is small and poorly bred.

In animal breeding, as in general farming, a little intelligent selection and care would greatly increase the farmer's net profit.

Farm labor.—According to information supplied by the Bureau of Statistics above referred to, the average wage paid to farm hands ranges from 12½ to 17 cents per day, or from $3.75 to $5 per month. Wages vary, however, in different parts of the province, also with the different seasons. For instance, during the harvest season transient labor from Shantung is paid as much as 28 cents (70 cents silver) per day, while at other seasons labor may be had for from 8 to 10 cents per day. Most of the farm labor of Manchuria comes each year from Shantung, Chihli, and Honan, and with the approach of winter returns to its provinces.

The Manchurian Government has recently offered to grant free transportation to all the people of Shantung, Honan, and other provinces who were willing to emigrate to the three eastern provinces and cultivate the untilled lands of Manchuria.

Land values and taxation.—The average value of agricultural lands, according to the statistics above referred to, ranges from $8.40 to $12.30 per acre for first-class land and from $5 to $7.50 per acre for second-class. The general average value per acre, therefore, would be $8.30. This appears to be an exceedingly low average, but it must be remembered that the values quoted are in United States currency, $1 of which is equal at the present rate of exchange to $2.50 in Manchurian currency, and that the cost of living, as between the inhabitants of Manchuria and Americans, is roughly in the ratio of 10 to 1, *i. e.*, where it costs the American equivalent of 10 silver (Mexican) dollars to live, the Manchurian will get along, in his way, on 1 silver dollar.

In the matter of taxation it is impossible, from the meager information obtainable, to make a statement which would even approximate the facts. There are land taxes, grain taxes, a salt tax, an opium tax, a tax per head on beef cattle and sheep, a butcher's tax, an export tax, a police tax, a school tax, etc. Certain of these taxes are fairly uniform throughout the province—*e. g.*, the salt tax—but in the main, they vary with each magistracy, according to the needs of the particular district or the caprice of the tax collector. The authorities never make public the state of the provincial or district revenues, neither the amount required per annum nor for what purposes the money is spent. Systematic and uniform taxation, coupled with the compilation and publication each year of financial budgets, would do much to correct many of the administrative evils which encourage deception and fraud in the payment of Government revenues and retard progress.

Agricultural development in Manchuria.—Prof. Edward C. Parker, of the University of Minnesota, who was recently employed by the Fengtien Government to establish an agricultural college and experiment station at Mukden, writing on the subject of agricultural development in Manchuria, says:

> It is the opinion of the writer that the chief problems of agricultural development in Manchuria at the present time are economic, social, and political problems, rather than scientific problems relative to the stimulation of greater productiveness in the soil. The vast acres of uncultivated land in the north are capable of producing a surplus crop for export even with crude methods of soil tillage, if transportation facilities could be developed to bring the farmer in touch with world markets. The agricultural problem of Manchuria is not so much the problem of making two blades of grass grow where one grew before, as to change the existing economic and social conditions of farm life into an advanced condition of commercial agriculture in which the farmer can produce a surplus of food above local demands and find a ready cash market for that surplus. While improved methods of agriculture are undoubtedly necessary if the Manchurian farmer is to produce a large surplus for export, it is still more necessary that there be a market and a means of reaching that market with the surplus crop. If good roads could connect with railways and waterways in Manchuria, and if capital could organize the facilities for storing and shipping staple agricultural products into every community, there is little doubt that Manchuria would produce a large surplus of crops for export, and in striving to produce a surplus the farmer would be quickened and fully awake to the advantages of improved methods of agriculture. The Manchurian farmer is not so much in need of the agricultural teachings of European and American applied science as he is in need of the far-sighted genius of such men as James J. Hill in the United States, and Shaughnessy in Canada, who built the steel paths of commerce into the fertile fields of North America and were content to wait for dividends until the settlers came in and opened the soil. To-day every farming community in America is in touch with the world markets, and being in possession of markets the agricultural problem of America is to increase production by the application of science to the art of agriculture. One hundred years ago the American farmer produced his food, fuel, and clothing on the land and exchanged very little of his crop for cash. Then as transportation facilities developed, and the inventive

genius of the American applied mechanical principles to agriculture, the old system of "produce-and-consume-what-you-produce" farming passed away and crop products are now exchanged for cash, and the farmer buys coal for fuel and factory goods for his clothes. The Manchurian farmer of to-day is in a stage of civilization more remote from the highest modern civilization than the American farmer of one hundred years ago, and this fact must be realized in considering any Government policy for the improvement of agriculture.

The Chinese character seems to lend itself to the adoption of new methods from demonstration rather than from reading or oral teaching, and thus in formulating plans for improving conditions in Manchuria the work of demonstration should have an important place. Government demonstration and experiment farms should be established in all the important regions of Manchuria and efforts be made to interest the farmers in simple machines such as plows and seed drills and in better methods of cultivation, in anticipation of the time when better markets for the surplus crops of Manchuria may develop. Such machines as the two-horse American plow are within the reach of the common people, and I am convinced that the people would be interested in such machines if they had the opportunity of witnessing their work.

The potential wealth of Manchuria lies to a far greater extent in the soil than in either timber or minerals, and should Manchuria ever be developed to its full possibilities its products both in quantity and quality would be as famous in the world's markets as the wheat of Canada and the cotton, corn, and beef of the United States. Manchuria is a country of tremendous agricultural possibilities.

AGRICULTURAL NOTES.

Weather conditions.—Notwithstanding the excessive rains in some provinces, excellent crops have been reported from San Jose, Nueva Ecija, and Candijay, Bohol. From last reports there was every indication of excellent crops of corn and tobacco at Carcar, Cebu; of hemp and coconuts at Luzurriaga, Oriental Negros; of maguey at Corella, Bohol, and Medellin, Cebu; of corn at Maasin, Leyte, Daui, Bohol, and Danao and Bontoyan, Cebu; of rice at Ligao, Albay; of sugar cane at Tadela, Cebu, Maragondon, Cavite, and Murcia. Occidental Negros; and sugar cane and maguey at Cabancalan and Talisay, Occidental Negros, Ibaan, Batangas, and Porac, Pampanga.

In San Pablo, Laguna, large quantities of coconuts were harvested, and a great deal of rice in the Provinces of Bulacan, Leyte, Tarlac, and Occidental Negros. In the municipalities of Leyte, Lepanto-Bontoc, Ilocos Norte, Ilocos Sur, Sorsogon, and Union, the corn, rice, and tobacco crops had every indication of giving satisfactory returns.

The rains and typhoons of the last rainy season, while they did a great deal of damage in some municipalities of Ambos Camarines, Albay, Sorsogon, and Samar, were in many places favorable to the development of growing crops, such as hemp and palay, so that, relatively speaking, little damage was done, aside from that occasioned by the typhoon of September 23 on the Island of Masbate and in the surrounding sections, where in some places practically all of the crops were destroyed. On the Island of Masbate some towns were almost entirely wiped out; in one instance only three houses were left standing in the town.

Droughts, which, however, were not serious, have been reported from Pinamungahan, Cebu; Sevilla, Bohol; Bato, Ambos Camarines, and several other localities.

In a number of places where there were no irrigation facilities, particularly on new plantations, the crops suffered from lack of water. This was so in the case of palay in Catarman, Samar, and Antequierra, Bohol. Corn and tobacco have also suffered from the same cause.

Rats.—In some municipalities of the Provinces of Rizal, Pangasinan, Albay, Ambos Camarines, Cebu, Bohol, Oriental Negros, Agusan, and the Moro Province, an unusual visitation of rats has done serious damage to the corn and palay crops. In Albay and Ambos Camarines their ravages seem to be worse than in other provinces, and Mr. David B. Mackie, agricultural inspector of this Bureau, was sent to investigate conditions and inaugurate a campaign against these pests. Mr. Mackie is devoting

all of his time to this work and it is expected that he will be able to obtain information as to the best methods of their destruction in the other provinces.

Worms, insects, and locusts.—In some provinces more or less damage has been done to the growing crops of rice, corn, coffee, and tobacco, by insects. Bataan and Pampanga report the presence of an insect borer which whitens the rice heads and prevents them from filling. This condition is called "uban" in Bataan and "managak" in Pampanga. An insect borer called "carcona," and a flying insect called "danguoo" were reported as having caused the loss of at least one-third of the rice crop in some towns of Pangasinan.

In Himamaylan, Occidental Negros, it is reported that the growing sugar cane has been somewhat damaged by flights of young locusts.

Animal diseases.—Rinderpest has appeared in different places, among others, at San Jose, Ambos Camarines, where it is supposed to have been introduced by cattle imported from Carmaon. Dr. H. A. Forrester, of Legaspi, immediately inoculated all of the animals exposed to contagion and placed both municipalities under quarantine. No further complaints have been received and it is believed that the disease is practically stamped out in this locality. Rinderpest also appeared in Guinan, Samar, Larena, Siquijor, and Inopacan, Maasin, and Palompon, Leyte. In most places, however, the disease seems to be disappearing and the inoculations made by the veterinarians of this Bureau have given very satisfactory results. In some places the disease developed largely because of lack of precaution on the part of owners failing to properly isolate infected cattle.

Foot-and-mouth disease has existed in a few municipalities, but generally speaking, it appears to be gradually decreasing and conditions are very much improved.

Harvests.—The Province of Tarlac has produced the best rice harvest during the past season, and following in order come the Provinces of Albay, Occidental Negros, Pangasinan, Ilocos Norte, Laguna, Zambales, and Ambos Camarines.

In the production of coconuts, Laguna stands first, and following it are Tayabas, Bohol, Samar, Cebu, Ambos Camarines, and Albay.

The production of hemp has not been as large as usual in many places owing to the prevailing low prices. However, Laguna, Albay, Sorsogon, and Samar have raised large quantities.

Cebu, Bohol, and Occidental Negros have raised the largest quantities of corn, while Occidental Negros, Batangas, Ilocos Norte, and Pangasinan have led in the production of sugar.

The last reports on the tobacco crop show that Cagayan, Union, Iloilo, Panay, and Ilocos Sur have produced satisfactory quantities. Other provinces have done well, although the amount produced has not been large.

CROPS PLANTED AND HARVESTED AND CONDITION OF SAME TAKEN FROM MONTHLY CROP REPORTS FOR THE MONTH OF JANUARY, 1909.

[RICE.—Attention is invited to the fact that rice should be understood as being in the unhulled state.]

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Hectare.	Quantity.	Unit.
		Hectares.			
Agusan (reports from 2 towns):					
Rice	Fair	10		175	Cavans.
Abaca	Good			575	Piculs.
Corn	do			200	Cavans.
Coconuts	do				
Albay (reports from 10 towns):					
Abaca	do	52	7,403	13,374	Piculs.
Coconuts	do			704,300	Nuts.
Corn	do	176	35	320	Cavans.
Rice	do	28	130,425	396,800	Do.
Ambos Camarines (reports from 20 towns):					
Rice	Fair	1,000	10,127	43,259	Do.
Abaca	Good	246	2,969	8,565	Piculs.
Coconuts	do			1,102,300	Nuts.
Sugar cane	do	22	19	22	Piculs.
Antique (reports from 6 towns):					
Sugar cane	do	124	96	2,860	Do.
Coconuts	do			60,000	Nuts.
Abaca	do		9	49	Piculs.
Cacao	do		6	25	Arrobas.
Bataan (reports from 5 towns):					
Sugar cane	do	5	9	540	Piculs.
Corn	Fair	35	29	330	Cavans.
Rice	Good	10		1,126	Do.
Abaca	do				
Batangas (reports from 12 towns):					
Rice	do		535	15,420	Cavans.
Sugar cane	do	357	423	11,800	Piculs.
Corn	do	243	395	4,295	Cavans.
Abaca	Fair		11	12	Piculs.
Benguet (reports from 9 towns):					
Coffee	do		16	110	Arrobas.
Rice	Good	63	3	60	Cavans.
Sugar cane	Fair			19	Piculs.
Bohol (reports from 26 towns):					
Coconuts	Good			1,571,000	Nuts.
Abaca	do	84	180	402	Piculs.
Corn	Fair	945	1,383	6,065	Cavans.
Rice	do	920	724	3,498	Do.
Bulacan (reports from 12 towns):					
Rice	Good	4,628	960	36,000	Do.
Sugar cane	do	918	85	780	Piculs.
Corn	do	92	10		
Tobacco	Fair	10			
Cagayan (reports from 11 towns):					
Corn	Good	716	2	100	Cavans.
Tobacco	do	2,240	3	100	Quintals.
Rice	do		339	4,906	Cavans.
Sugar cane	do	8	2	5	Piculs.
Capiz (reports from 14 towns):					
Abaca	Fair	15	42	125	Do.
Coconuts	do			56,000	Nuts.
Tobacco	do	175			
Sugar cane	Good	25	55	946	Piculs.

Crops planted and harvested and condition of same taken from monthly crop reports for the month of January, 1909—Continued.

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Area.	Quantity.	Unit.
Cavite (reports from 5 towns):		*Hectares.*			
Rice	Good		4,785	8,250	Cavans.
Corn	do	5	12	150	Do.
Abaca	do		50	100	Piculs.
Sugar cane	do	26	80	2,400	Do.
Cebu (reports from 29 towns):					
Coconuts	do			1,109,046	Nuts.
Corn	Fair	1,472	16,350	158,337	Cavans.
Rice	Good	121	425	4,800	Do.
Sugar cane	do	277	314	3,553	Piculs.
Ilocos Norte (reports from 7 towns):					
Rice	do		8,893	178,820	Cavans.
Sugar cane	do	323	226	674	Piculs.
Tobacco	do	70	40		
Maguey	do	122	35	100	Do.
Ilocos Sur (reports from 20 towns):					
Corn	do	1,288	52	365	Cavans.
Tobacco	do	251			
Sugar cane	Fair	387	441	3,277	Piculs.
Rice	do		4,324	23,040	Cavans.
Iloilo (reports from 9 towns):					
Rice	Good		2,710	37,810	Do.
Abaca	Fair	465	72	356	Piculs.
Sugar cane	Good	57	167	4,095	Do.
Corn	do	1,068			
Isabela (reports from 2 towns):					
Tobacco	Fair	200			
Corn	do	50			
La Laguna (reports from 16 towns):					
Abaca	Good	8	384	206	Do.
Coconuts	do			6,939,000	Nuts.
Rice	Fair	401	4,232	102,500	Cavans.
Sugar cane	do	100	312	2,050	Piculs.
La Union (reports from 10 towns):					
Tobacco	Excellent	1,145			
Coconuts	Good			45,500	Nuts.
Sugar cane	do	91	75	823	Piculs.
Rice	Fair		3,051	12,200	Cavans.
Lepanto-Bontoc (reports from 14 towns):					
Rice	do	221	583	9,721	Do.
Corn	Good	15	94	473	Do.
Sugar cane	Fair	1	27	202	Piculs.
Tobacco	Good	182	130	100	Quintals.
Leyte (reports from 15 towns):					
Rice	do	3,924	771	25,080	Cavans.
Abaca	do	22	3,617	15,643	Piculs.
Corn	Fair	244	118	582	Cavans.
Coconuts	Good			554,907	Nuts.
Mindoro (reports from 1 town):					
Abaca	Fair	10	100	200	Piculs.
Coconuts	do			12,000	Nuts.
Corn	do		25	25	Cavans.
Misamis (reports from 4 towns):					
Rice	Good		60	1,800	Do.
Coconuts	do			276,342	Nuts.
Corn	do	80	62	690	Cavans.
Abaca	do	35	115	700	Piculs.
Moro Province (reports from 4 towns):					
Rice	do	2	150	7,000	Cavans.
Coconuts	do			158,159	Nuts.
Sugar cane	do	80	2	1	Picul.
Corn	do	5	10	205	Cavans.
Nueva Ecija (reports from 17 towns):					
Rice	Fair		11,006	375,650	Do.
Sugar cane	do	68	99	640	Piculs.
Tobacco	Good	152			
Corn	do	38	52	8	Cavans.
Nueva Vizcaya (reports from 4 towns):					
Rice	do				
Coconuts	do			96,000	Nuts.
Sugar cane	Fair				
Corn	do				

Crops planted and harvested and condition of same taken from monthly crop reports for the month of January, 1909—Continued.

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Area.	Quantity.	Unit.
		Hectares.			
Occidental Negros (reports from 15 towns):					
Sugar cane	Good	6,477	13,610	255,475	Piculs.
Rice	Fair	2	2,820	71,960	Cavans.
Coconuts	Good			205,530	Nuts.
Corn	do	181	344	82,010	Cavans.
Oriental Negros (reports from 14 towns):					
Sugar cane	Fair	46	82	2,405	Piculs.
Rice	do	6	218	2,480	Cavans.
Coconuts	Good			844,500	Nuts.
Corn	Fair	73	347	3,810	Cavans.
Pampanga (reports from 8 towns):					
Sugar cane	Good	2,645	1,690	2,680	Piculs.
Corn	do	170			
Rice	do	1,270	2,150	4,000	Cavans.
Pangasinan (reports from 28 towns):					
Rice	do		17,785	243,836	Do.
Coconuts	do			384,864	Nuts.
Sugar cane	Fair	172	886	5,090	Piculs.
Corn	Good	183	131	606	Cavans.
Rizal (reports from 13 towns):					
Abaca	do				
Sugar cane	do	11	112	22	Piculs.
Rice	Fair		3,500	3,500	Cavans.
Corn	do	50	13	225	Do.
Samar (reports from 21 towns):					
Rice	do	1,951	196	2,672	Do.
Abaca	do	135	1,592	5,876	Piculs.
Coconuts	do			1,290,270	Nuts.
Sugar cane	do	36	57	125	Piculs.
Sorsogon (reports from 15 towns):					
Rice	do	1,259			
Abaca	do	656	7,557	11,499	Do.
Coconuts	do			39,300	Nuts.
Sugar cane	do	14	61	27	Piculs.
Surigao (reports from 2 towns):					
Rice	Good	300			
Abaca	do		30	100	Do.
Coconuts	do			5,000	Nuts.
Sugar cane	Fair	2	1	5	Piculs.
Tarlac (reports from 11 towns):					
Rice	do	202	73,196	717,155	Cavans.
Sugar cane	do	1,452	3,933	4,311	Piculs.
Tobacco	do	129			
Corn	do	3			
Tayabas (reports from 13 towns):					
Corn	Good	45	11	110	Cavans.
Rice	do	4,776	10		
Abaca	do	3,668	149	369	Piculs.
Coconuts	Fair			3,236,800	Nuts.
Zambales (reports from 8 towns):					
Coconuts	Good			23,000	Do.
Sugar cane	do	37	100	788	Piculs.
Corn	Fair	7	5	250	Cavans.
Rice	Good		3,403	82,375	Do.

RANGE OF PRICES OF PHILIPPINE AGRICULTURAL PRODUCTS.

Highest, lowest, and average of rice, abaca, copra, sugar, tobacco, and corn for the month of January, 1909.

Province.	Rice, unhulled, per cavan.			Abaca, per picul.			Copra, per picul.		
	Highest.	Lowest.	Average.	Highest.	Lowest.	Average.	Highest.	Lowest.	Average.
Agusan	₱3.00	₱2.00	₱2.50	₱7.00	₱7.00	₱7.00	₱5.00	₱5.00	₱5.00
Albay	3.65	1.75	3.60	8.50	5.50	6.31	7.00	4.25	5.96
Ambos Camarines	4.00	1.50	2.89	13.00	3.00	6.60	7.50	4.00	5.89
Antique	2.50	1.50	2.04	18.00	12.00	15.75	6.50	6.50	6.50
Bataan	2.50	2.00	2.12						
Batangas	3.25	2.00	2.75	17.00	17.00	17.00	3.90	3.90	3.90
Benguet	5.00	3.00	4.10						
Bohol	3.75	2.00	2.96	15.00	2.50	10.36	8.50	6.25	7.24
Bulacan	2.50	1.80	2.09						
Cagayan	4.25	3.50	4.00						
Capiz	4.00	1.80	2.57	18.00	5.00	12.28	7.10	5.00	6.06
Cavite	2.60	2.00	2.26	15.00	15.00	15.00	5.00	5.00	5.00
Cebu	4.50	1.90	3.04	20.00	10.00	13.01	10.00	3.00	7.84
Ilocos Norte	5.50	4.00	5.00						
Ilocos Sur	5.00	2.75	4.34						
Iloilo	4.00	3.50	2.78	20.00	16.00	17.33	7.50	6.50	6.28
La Laguna	3.50	2.40	2.81	15.00	7.00	10.50	7.00	5.50	5.88
La Union	5.00	3.00	3.68				8.00	6.25	6.56
Lepanto-Bontoc	4.00	3.00	3.55						
Leyte	3.50	2.50	3.11	14.00	5.00	9.77	10.00	3.00	6.39
Mindoro	3.00	3.00	3.00	11.00	11.00	11.00	5.00	5.00	5.00
Misamis	3.00	2.00	2.66	11.00	6.00	8.64	7.80	7.00	7.28
Moro Province	2.50	2.00	2.35	15.00	6.60	10.70	7.00	6.50	6.87
Nueva Ecija	3.55	1.25	1.62						
Nueva Vizcaya	3.12	1.00	1.87						
Occidental Negros	3.00	2.50	2.52	15.00	11.00	13.11	8.50	3.00	6.13
Oriental Negros	4.00	2.50	3.27	14.00	6.50	9.20	8.50	6.00	7.42
Palawan	3.00	2.75	2.87				5.50	5.50	5.50
Pampanga	2.20	1.80	2.05						
Pangasinan	4.50	2.00	3.10				7.50	2.50	5.75
Rizal	2.75	2.50	2.54	18.00	18.00	18.00			
Samar	4.50	2.50	3.40	14.50	9.00	11.39	7.50	5.00	6.12
Sorsogon	5.00	2.00	3.22	16.00	5.75	10.29	6.50	3.50	5.32
Surigao	3.00	2.50	2.75	12.50	10.50	11.50	7.50	7.00	7.12
Tarlac	3.75	1.40	2.45						
Tayabas	5.00	2.00	4.70	15.00	4.00	9.67	6.50	4.25	5.38
Zambales	4.50	1.50	1.80				10.00	2.50	5.25

Highest, lowest, and average of rice, abaca, copra, sugar, tobacco, and corn for the month of January, 1909—Continued.

Province.	Sugar, per picul.			Tobacco, per quintal.			Corn, per cavan.		
	Highest.	Lowest.	Average.	Highest.	Lowest.	Average.	Highest.	Lowest.	Average.
Agusan							₱2.50	₱2.00	₱2.25
Albay	₱7.00	₱6.00	₱6.33				5.00	1.50	3.13
Ambos Camarines	6.00	4.00	4.50				4.00	1.50	2.66
Antique	3.25	2.50	2.91						
Bataan	5.00	4.00	4.50				3.00	1.50	2.25
Batangas	4.00	3.00	3.28	₱8.00	₱8.00	₱8.00	3.50	2.00	2.69
Benguet	6.00	4.00	5.00						
Bohol	5.00	4.00	4.25	2.50	2.50	2.50	4.00	2.00	3.08
Bulacan	6.00	6.00	6.00	10.00	10.00	10.00	3.00	3.00	3.00
Cagayan	4.00	3.00	3.66	15.00	8.00	11.60	4.00	2.50	2.90
Capiz	6.00	3.00	5.40	10.00	8.00	9.33	2.00	2.00	2.00
Cavite							3.00	1.50	2.25
Cebu	5.20	2.00	4.19	25.00	4.50	14.19	5.00	2.25	2.57
Ilocos Norte	4.00	2.00	3.00	19.00	4.00	11.50	3.00	2.50	2.83
Ilocos Sur	7.00	2.80	3.43	35.00	16.00	32.75	5.00	1.25	3.03
Iloilo	6.00	4.75	4.57	40.00	7.00	15.02	3.00	2.80	2.90
La Laguna	4.00	3.00	3.75				3.00	2.50	2.66
La Union	5.00	3.00	3.80	9.00	2.00	6.00	1.00	1.00	1.00
Lepanto-Bontoc	7.00	2.50	4.16	13.00	4.00	8.33	5.00	3.00	4.06
Leyte	6.00	3.00	4.40	30.00	2.00	22.60	3.50	1.50	2.70
Mindoro							2.50	2.50	2.50
Misamis	4.00	4.00	4.00	25.00	20.00	22.00	3.00	1.50	2.45
Moro Province	5.25	5.25	5.25				2.50	2.50	2.50
Nueva Ecija	7.50	2.50	5.85	20.00	8.00	11.57	1.50	1.50	1.50
Nueva Vizcaya				20.00	5.00	18.00	2.00	1.50	1.70
Occidental Negros	5.50	3.00	4.21	35.00	30.00	32.50	3.00	2.00	2.33
Oriental Negros	4.00	4.00	4.00	30.00	4.00	12.25	6.00	2.20	3.74
Palawan				20.00	20.00	20.00			
Pampanga	6.00	4.00	4.90				2.60	2.00	2.31
Pangasinan	6.50	3.00	4.18	10.00	5.00	8.47	5.00	1.50	2.55
Rizal	5.00	3.50	3.83	3.75	3.75	3.75	2.50	1.50	2.00
Samar	6.00	5.00	5.50	6.00	6.00	6.00	2.50	2.50	2.50
Sorsogon	3.50	2.50	2.85				3.25	2.00	2.32
Surigao	4.00	4.00	4.00	15.00	9.00	12.00	1.50	1.50	1.50
Tarlac	4.00	2.00	3.40	12.00	8.00	10.00	2.20	2.00	2.10
Tayabas	3.00	3.00	3.00	8.00	6.00	6.66	5.00	5.00	5.00
Zambales	5.00	3.00	4.88	25.00	12.00	18.50	5.00	2.00	3.50

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PERIODICALS RECEIVED IN THE LIBRARY OF THE BUREAU OF AGRICULTURE.

ENGLISH.

Agricultural Bulletin of the Straits and Federated Malay States, Singapore.
Agricultural Gazette, Sydney, New South Wales.
Journal of the Department of Agriculture of Victoria, Melbourne, Australia.
Journal of the Department of Agriculture, Perth, Western Australia.
Queensland Agricultural Journal, Brisbane.
Tropical Agriculturist, Colombo, Ceylon.
Hawaiian Forester and Agriculturist, Honolulu.
Memoirs of the Department of Agriculture, Calcutta, India.
Natal Agricultural Journal, Pietermaritzburg, Natal, South Africa.
Agricultural News, Bridgetown, Barbados.
West Indian Bulletin, Bridgetown, Barbados.
California Cultivator, Los Angeles, California.
Farmer and Fruit Grower, Jacksonville, Florida.
Louisiana Planter, New Orleans, Louisiana.
Southern Cultivator, Atlanta, Georgia.
Progressive Farmer, Raleigh, North Carolina.
Farmer's Guide, Huntington, Indiana.
Independent Farmer, Lincoln, Nebraska.
Kansas Farmer, Topeka, Kansas.
Farm Press, Chicago, Illinois.
Exporters and Importers Journal, Chicago, Illinois.
Oregon Agriculturist, Portland, Oregon.
Journal of Agriculture and Horticulture, Montreal, Canada.
Tropical Life, London.

Crop Reporter. By the Secretary of Agriculture, Washington, D. C.
Federal Reporter, New York, New York.
Smith and Schipper's Monthly Report, New York.
Hemp Market Report, Landauer & Company, London.
Ide and Christie's Monthly Circular, London.

Official Gazette, Manila, P. I.
Philippine Journal of Science, Manila, P. I.
Far Eastern Review, Manila, P. I.
Weather Bureau Bulletins, Manila, P. I.

SPANISH.

Boletin de la Cámara de Comercio Filipina, Manila, P. I.
Boletin de Agricultura, San José, Costa Rica.
Hacendado Mexicano, El, Mexico, Mexico.
Anales Agronómicos, Santiago de Chile.
Prácticas Modernas é Industrias Rurales, La Coruña, Spain.
Hacienda, La, Buffalo, New York.

OTHER LANGUAGES.

Bulletin de la Chambre de Commerce de Saigon, Indo-China.
Boletim Economique, Indo-China, Hanoi, Haiphong.
Boletim de Agricultura, Sao Paolo, Brazil.
Boletin de Museu Gœldi, Para, Brazil.
Tamil Journal of South India Agriculture, Madras, India.
Station Agronomique, Port Louis, Colony of Mauritius.
Journal D' Agriculture Tropicale, Paris.
Der Pflanzer, Kommunal-Druckerei, Tanga, Dutch, East Africa.
Berichte über Land-und Forstwirtschaft in Deutsch-Ostafrica, Heidelberg, Germany.

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EDITORIAL.

LAWS TO PREVENT THE INTRODUCTION OF PLANT PESTS.

The attention of the readers of this number of the REVIEW is invited to the ordinance to prevent the introduction of plant pests into the Straits Settlements and the extract from the report of the government entomologist of Hawaii for November and December. The fact that the importance of this matter has been recognized by the government of the

Straits Settlements and the government of Hawaii by appropriate legislation is significant. The extract from the report of the government entomologist in Hawaii for November and December is in itself *prima facie* evidence of the need of laws to prevent the introduction of plant pests and diseases in all countries wholly or nearly surrounded by the sea, where a large part of the vegetables consumed by the people are imported from other countries, and where, as is the case in the Hawaiian Islands, the Philippines, and the Straits Settlements, a great many new plants are being imported from foreign countries for the purpose of promoting agriculture.

Our Government has given considerable attention to enacting laws to prevent the importation of animals infected with contagious diseases and to provide for the isolation and quarantine of animals infected with such diseases in the different parts of the Islands. It is believed that some satisfactory law providing for the inspection of the plants and vegetables which are imported into these Islands and for guarding against the introduction of plant pests and diseases which are common in other countries would be beneficial to our public health and progress.

AGRICULTURAL EXHIBITIONS.

In this number of the REVIEW we are giving an account of the agricultural exhibitions at Medan, Sumatra, the annual agri-horticultural show of Perak, and the balance sheet of the agri-horticultural show of Selangor.

The account of the agricultural exhibition held at Medan, Province of Deli, Sumatra, it is believed, will be particularly interesting to the tobacco growers of the Philippines, as Sumatra is known the world over for its superior grades of tobacco, particularly its leaf tobacco which is used for wrappers by nearly all of the leading cigar factories in the world. At the Medan exhibition nursery beds with vigorous living specimens of the different kinds of tobacco plants grown in Sumatra were shown, giving planters the advantage of seeing other kinds of tobaccos than those usually cultivated on their own estates. Samples of the different kinds of tobacco soils from the leading tobacco estates in Deli, Langkat, Serdang, etc., as well as a complete equipment of apparatus for the analysis of soils, were on exhibit. In addition to this a complete series of plants affected by diseases common to the tobacco plant were exhibited under glass cases, showing the different stages of the diseases, and the insects which in many cases produce them, so that each disease could be easily studied. Further than this many phases of tobacco culture were illustrated by large photographs.

In connection with the account of the exhibition at Medan we have reproduced a brief sketch of the country and the conditions that prevail on the tobacco estates in Deli and Sumatra, which will give Philippine

tobacco growers a very fair idea of the environment and conditions under which the tobacco-growing industry is carried on in Netherlands India.

The agri-horticultural show which was held at Kuala Kangsar in Perak, is an annual affair in the State of Perak. At the fairs held in the Federated Malay States the leading exhibits are of the rubber-growing industry. It is claimed that these fairs are a great stimulus and source of information and progress to the planters of the States; that they spread a desire amongst the natives to improve their different cultivations and give a great deal of help to those engaged in tropical agriculture, by indicating the direction in which the greatest assistance is needed, and the manner in which it can best be given. These shows are not only a financial success, as is shown by the credit balance of $712.28 for the fair at Kuala Kangsar, but they increase in excellence from year to year, the quality of the exhibits being much in advance of those of former years.

From the balance sheet of the agri-horticultural show held at Kuala Lumpor in Selangor, we can see something of the plan of the exposition and its business management, showing the methods of promoting expositions by prizes, medals, and money awards, as well as by advertising, which, when all the receipts are totaled and the expenses paid, give a cash balance of $2,327.40 in the bank. This account of these fairs and exhibitions in the Federated Malay States and Netherlands India show how far in advance of us these countries are in agricultural development and progress. Such exhibitions from the various parts of a province, state, or island stimulate local pride in their agricultural products and progress, and these in turn create a desire for better knowledge of agriculture as well as better business, and better means of communication; which, perhaps, are the greatest needs for elevating the standard of living in the country in these Islands and for encouraging the organization of the people of the country into guilds, unions, or granges for promoting the different lines of agricultural work in which they are interested.

It is hoped that the bill recently introduced into the Assembly providing for the holding of provincial industrial and agricultural exhibitions in these Islands, or a bill that will meet the present needs of the country, will become a law, and that it will meet with a hearty response and its provisions be immediately taken advantage of by the people of the provinces.

AGRICULTURE IN THE FEDERATED MALAY STATES.

Perhaps one of the most interesting articles in this number of the REVIEW, to a great many of our readers, will be the discussion of the progress of agriculture in the Federated Malay States by the director of agriculture for the Federated Malay States.

While the bureau of agriculture in the Federated Malay States has been organized for only three years there are several phases of its work which are of interest to agriculturalists in the Philippines. We refer more especially to the division of mycology and the work of the government mycologist in Singapore, also to the carefully made experiments in rice or *padi* culture, and to the attention which is given to the coconut industry by the appointment of an inspector and assistant inspector of coconuts.

The table giving the acreage of the different crops which are grown in the Federated Malay States shows the rubber-growing industry decidedly in the lead of all other agricultural work and that the acerages of coconuts and coffee plants follow in the order named.

The account of rice growing in the Federated Malay States, together with the detailed statement regarding the experiments which were carried on with different varieties of rice, should be interesting to Philippine rice growers. In the Federated Malay States about 70,000 acres of rice land have been supplied with comprehensive irrigation works, which thus far have given an increase of from 30 to 40 per cent in the crop harvested. Under the discussion of the enemies of the rice plant, Philippine farmers will see that the farmers of the Federated Malay States have to combat very much the same pests and insect enemies, such as rats, eelworms, and fungi, that we have to contend with here in the Philippines. The table tabulating the results of the experiments carried on with the different varieties of rice planted shows the time of planting seed, the dates transplantings were made, how many plants were set together in a hill or "perdu," the distance between settings or "perdus," the number of plants and "perdus" per acre, the date of harvesting the crop, the amount of the crop in gantongs or gallons and pounds per acre, the weight of straw per acre, also the number of grains in one gram and the number of seeds per head for each variety.

However, the larger part of this discussion and by far the most interesting and remarkable feature of it is that showing the growth and development of the rubber-growing industry in the Federated Malay States during the last ten years. This is well illustrated in the accompanying map and chart which is reproduced with the article. The increase in the acreage and the number of trees planted in the Federated Malay States during the last ten years is perhaps without parallel in the development of any other agricultural product in any part of the world. Not only has the development of rubber planting and rubber growing in the Federated Malay States been decidedly remarkable, but the possibilities for the future development and production of plantation rubber from the estates already planted and under cultivation quite equal, if they do not surpass, the progress made by our neighbors in rubber growing during the past ten years. The achievement is so great that we are disposed to ask our agriculturalists in the Philippines, Are

not such achievements possible in these Islands? and, What would be the result of such an achievement on the agricultural and commercial status of this country?

COUNTRY LIFE COMMISSION.

Our purpose in presenting these articles from the pens of President Roosevelt and the Editor of the Outlook is not for their intrinsic value to citizens of the United States, but for their suggestiveness to those of us who are responsible for, and must solve, the problem of country life in the Philippines. Life in the country in these Islands is the foundation of all of the national aspirations and of the future greatness of the Filipino people. It is the country life in the Philippines more than anything else that needs to be awakened and quickened.

The politician is in the very center of the stage of the popular life of the people at the present time. The Filipino Government official is everything. The country seems to be dormant, and the people in the country depend upon the officeholders and politicians for all remedies of present evils and for the improvement of conditions. In the mind of the average country resident the situation is entirely in the hands of the lawmakers, and they, the people in the country, are doing little or nothing, resting in the conviction that everything that is necessary to bring about the much-needed changes for the progress of the country, can be accomplished by their officials and lawmakers. Nothing could be further from the truth. There is no such thing as independent national or state government without resources; and laws are primarily for the regulation of the conduct of the people. Laws can not make the people industrious nor can they fundamentally create resources. Abundant resources and wealth are the foundation of national life, as well as of the life of a business corporation. The country, the farmer, and the rural population, are the resources and the fundamental producers of wealth—the foundation of national existence—and through them only can national existence be made possible.

The recent protest of the sugar planters is much like a protest against the building of a house without a foundation. This is the first voice which has been heard from the land, from the country people. They are the very people that need to be encouraged to speak for themselves, and life in the country needs to be stimulated and given every possible support and encouragement. In fact, it should be made the center of attention both of the people and the Government. The eyes of the public should be turned to the farmers and the country people, and they should be placed in the center of the stage of action. For a time, at least, the politician can well be forgotten and left to work out his problems, not so much in the public forum, but rather in conference with the people who are the real producers of wealth.

For the past eight years we have been facing the condition of importing annually an average of ₱13,758,890 worth of rice; ₱154,570 worth of coffee; ₱368,114 worth of cacao and chocolate; ₱237,248 worth of sugar; ₱552,108 worth of eggs; ₱14,216,238 worth of cotton goods. The United States might as reasonably import her wheat, milk, butter, meat, and potatoes. *Such a national foundation is as frail as straw and as unstable as water; such a condition is a condition of dependence and not independence.* A country in which the people will not produce the food staples necessary for their own subsistence and right living, when the land naturally produces such products, can be nothing more than a dependency no matter how brilliant its statesmen and professional men.

The editor knows of no better expression or statement of the needs of the people and the government of this country—in order that the Filipinos may attain to the ends most desired by them—than the following by a prominent Filipino:

> We should earn sufficient money to live in such a manner as to produce healthy and vigorous children, and educate them so that their earning capacity will be still greater. In which case, I swear upon my honor that our grandchildren with their health, education, and money will be independent in spite of èverything. * * * America freed herself from England because she had men, money, and true patriots.

In his message President Roosevelt points out the various agencies for the improvement of country life, namely:

(1) The National Department of Agriculture,
(2) The State departments of agriculture,
(3) The State colleges of agriculture,
(4) University and agricultural extension work.
(5) Agricultural experiment stations,
(6) Farmers' unions,
(7) The Grange, and
(8) The agricultural press.

In the Philippines we have but few of these agencies in either the Insular, provincial, and municipal government organizations or among the people. Act No. 1829 provides for civico-educational instruction, yet the need of agents or officials charged with the responsibility for improving the existing conditions of country life is manifest and decidedly emphatic to anyone who fairly considers the situation.

The President emphasizes the importance of organization on the part of the farmers themselves, and states that the country people must organize to protect their interests as well as any other class of industrial workers. The Government can point out the way, but as indicated, the country people must coöperate and must give dignity and attractiveness, as well as better results from the farms, if country life is made all that it can and should be. In the Philippines we not only

need better farming, which the Bureau of Agriculture is endeavoring to stimulate and encourage, but we most emphatically need *better business* and *better living on the farms.* President Roosevelt states that the farmers' problems are the whole country's problems. The President further asserts that neglect of this subject has held back country life and lowered the efficiency of the whole nation. Perhaps no other subjects received so little attention during the period in which the Philippine Islands were governed by the Spaniards as the education and elevation of the people in the country, and work for the improvement and development of those things which were for the best interests of the country people. The President declares that the strengthening of country life is the strengthening of the nation; that while the growing of crops is an essential foundation, it is only a part of the life of the people in an intelligent and progressive country; that it is literally vital that the farmer, his wife, and his children shall lead the right kind of life. He believes that the National Department of Agriculture should become a department of country life, fitted to deal not only with crops, but with questions pertaining to all of the larger aspects of life in the open country.

President Roosevelt points out three great needs of country life, namely:

I. *Effective coöperation among farmers to put them on a level with the organized interests with which they do business.*

II. *A new kind of schools in the country which shall teach the children as much outdoors as indoors and perhaps more, so that they will prepare for country life and not, as at present, mainly for life in town.*

III. *Better means of communication, including good roads and a parcels post.*

In addition to these he suggests a fourth, viz:

Better sanitation. Inasmuch as many easily preventable diseases hold millions of country people in the slavery of continuous ill health.

In conclusion, President Roosevelt warns our countrymen that the great recent progress in city life is not a full measure of our civilization, for our civilization rests at bottom on the wholesomeness, the attractiveness, and the completeness, as well as the prosperity of life in the country. The men and women on the farm stand for what is fundamentally best and most needed in our American life.

PHORMIUM TENAX, A COMPETITOR OF SISAL AND MANILA HEMP.[1]

Phormium tenax has at least one advantage over its rivals in that its yield per acre is considerably higher than the yield per acre of abaca and sisal.

Taking sisal, to begin with, in Yucatan the weight averages about 50 pounds to forty leaves, 4 per cent of which becomes profitable fiber, or 2 pounds of fiber per plant of forty leaves. Allowing 1,000 plants to an acre, the yield of fiber is about 17 to 18 hundredweight per acre. The green leaf is usually harvested when it is three or four years old, but it has been placed on record—so that fact must be a notable one—that a two years' old plantation produced 1½ tons of fiber per acre. In Hawaii, whose porous, coral soil is admirably suited to its growth, as much as 3 tons 15 hundredweight to the acre has been yielded, but this agave was in a highly cultivated state.

Manila or abaca has even a smaller percentage of fiber per acre. Under favorable conditions anything from 6 to 9 hundredweight per acre is produced, although the average yield throughout the Islands is considerably below that figure, being a little over 3 hundredweight per acre. The life of the plant or root lasts from twelve to fifteen years, and from ⅓ pounds to 1 pound of fiber is obtained from a single stalk. In southern Mindanao the yield is something like 48 tons of stalks to a ton of fiber. The average amount of fiber produced is about 1½ per cent.[2]

Coming to our own hemp the green leaf per acre in this district is anything from 20 to 32 tons, though it is sometimes considerably above the latter figure. Allowing 8 tons of green leaf to one of fiber, and taking the above figures, the yield would be 2½ to 4 tons per acre. Allowing 7½ tons of leaf to a ton of fiber, the yield would be 2⅔ to 4¼ tons of fiber per acre.

Of course the writer is taking these figures, dealing with the yield of our own hemp, only for the purpose of striking an average. The quantity of green leaf per acre often varies considerably in the same block. About 12½ per cent of green leaf becomes fiber, although some millers get over 13 per cent.

[1] From the Auckland Weekly News, February 18, 1909.

[2] While these figures are correct for the hand-stripping process this amount can and doubtless will be increased two or three times by the use of satisfactory machinery.—EDITOR.

Maguey or henequen, which is another variety of sisal, yields from 5 to a little over 7 hundredweight of fiber per acre. The Philippine exports of this fiber increased from 875 tons in 1901 to 2,328 tons for the first nine months of 1906.

The hemp graded during the month of January was 6,323 bales, as compared with 12,086 bales for January, 1907, a decrease of nearly 50 per cent. For the year ending January 31, 1909, 83,606 bales were graded, a decrease for the year of 55,414 bales.

There is an interesting article in the London Field dealing with New Zealand flax, in which the writer states that 15 per cent of the green leaves are pure fiber, and the plant is as tenacious of life as a dock, provided the conditions of soil and climate are suitable. The great obstacle to the plant becoming of first importance among the world's vegetable fibers is the difficulty experienced of arriving at a process that will extract the fiber at a reasonable cost. "The prospect of labor in New Zealand being more costly than in other countries, where *Phormium tenax* can be cultivated, is likely to widen the field of this particular industry." The writer mentions the following localities where it is grown, and where it would thrive: Devon, Cornwall, Scilly Islands, and parts of Ireland.

Attempts are being made to introduce the *Phormium* industry into the United States, and in St. Helena there have been plantations of it for years, where it is being systematically cultivated. The author of the article concludes by referring to its white, silky texture, with a higher breaking strain than either hemp or flax. He states the fiber would be assured of a market, provided the natural quality was retained, if the supply were increased a hundred fold of what it is at present.

THE PRODUCTION AND CONSUMPTION OF CACAO.[1]

The "Gordian" has recently published (July 23, 1908) some interesting statistics regarding the production and consumption of cacao during the past few years. It appears that while the production for 1907 may be considered satisfactory upon the whole, it is 400,000 kilograms less than that of 1908 and 3,000,000 kilograms less than that of 1904. This deficit is due solely to a shortgage in the production in Ecuador and the Dominican Republic, the output for these countries being 8,000,000 kilograms less in 1907 than in 1906.

The table which we reproduce below gives in kilograms the exportation of cacao from the principal cacao-producing countries, for the years 1906 and 1907:

PRODUCTION.

Country.	1906 (kilograms[a]).	1907 (kilograms).
Brazil	25,135,000	24,528,000
St. Thomas	24,619,560	24,193,980
Ecuador	23,426,897	19,670,571
Trinidad	12,983,467	18,611,430
Venezuela	12,864,609	13,471,090
English East Africa	9,738,964	10,471,090
Dominican Republic	14,312,992	10,101,374
Ceylon	2,509,622	4,699,559
New Granada (Colombia)	4,931,530	4,612,100
Fernando Po	1,557,864	2,438,821
Jamaica	2,505,608	2,218,741
German colonies	1,367,977	1,966,236
Haiti	2,107,905	1,850,000
Dutch East Indies	1,849,847	1,800,153
Cuba	3,271,969	1,689,668
Surinam	1,480,568	1,625,274
French colonies	1,262,090	1,387,219
St. Lucia	716,200	750,000
Dominica	572,948	580,000
Congo Free State	402,429	548,526
Other countries	1,000,000	1,000,000
Total	148,618,046	148,136,537

[a] One kilogram equals 2.20462 avoirdupois pounds.

Regarding the exportations from Ecuador we may add that the official reports have confirmed, with a difference of several thousand kilograms, the figures of the "Gordian" (19,703,804 kilograms instead of 19,670,571 kilograms). The estimated crop for 1908 in this country amounts to over 30,000,000 kilograms.

[1] From the "Journal d'Agriculture Tropicale," December, 1908.

The production of 1,387,219 kilograms attributed to the French colonies is distributed as follows:

	Kilograms.
Guadalupe	781,511
Martinique	502,789
Congo	74,733
Madagascar	19,041
Guiana	3,807
New Caledonia	2,352
Ivory Coast	1,993
Réunion, Mayotte, and Indo-China	953

Among the German colonies Cameroon leads with 1,797,614 kilograms, Samoa follows with 116,500 kilograms, and Togo with 52,122 kilograms showing an enormous increase over the preceding year.

The record for the English colonies of West Africa is as follows: Gold Coast 9,504,000 kilograms, and Lagos 970,745 kilograms.

CONSUMPTION.

In consumption of cacao for the year 1907 the United States leads with 37,526,505 kilograms; then comes Germany with 34,515,400 kilograms; France with 23,180,300 kilograms; England 20,159,472, Holland 12,219,249, Switzerland 7,124,200, Spain 5,628,239, Austria 3,471,700, Belgium 3,253,967, Russia, Italy, Canada, Denmark, etc., with a total of 7,619,809 kilograms.

THE AGRICULTURAL EXHIBITION AT MEDAN, SUMATRA, AUGUST 31, 1908.[1]

The exhibition was held on the esplanade facing the station, the area of which is said to be about 7 acres in extent, and so numerous were the buildings that every part of it was covered. The arrangements were in the hands of a general purposes committee with the resident of the east coast as president and each of the eight divisions was managed by sub-committees. The divisions were as follows: (*a*) Buildings, (*b*) industrial arts, (*c*) chinese, (*d*) agriculture, (*e*) cattle, (*f*) Battak, (*g*) Amusement, and (*h*) fisheries. Judging from the admirable way every thing seemed to work, the organization was excellent. The buildings were solid structures of planking, with *atap* roofs, and I was informed that the large structure known as the feast tent, put up a little while ago by the railway company when celebrating their twenty-fifth anniversary, cost 8,000 guilders.

The building allotted to the agricultural section was a lofty-domed octagonal structure with avenues radiating from it. The central portion contained the very complete collections of tobacco leaves of nearly every known kind of tobacco; whilst outside the building on one side was a series of nursery beds showing the tobacco plants in vigorous growth. This was a wise precaution, for at this season the tobacco grown on the estates is all harvested, so that it gave visitors an opportunity of seeing the living plants and planters of seeing other kinds of tobacco than those usually cultivated on their estates.

In addition to the different kinds of tobacco shown in the central hall, the director of the agricultural experimental station showed a complete series of plants under glass cases which were more or less affected by diseases which prey on tobacco, together with the distinctive insects in their various stages, all neatly set up in glass cases, easy to inspect and study. To supplement the above, there were a number of huge photographs on the walls all of which illustrated some phase of tobacco culture. Not less interesting were the samples of soils from different parts of Sumatra, Deli, Langkat, Serdang, and other places, also a complete equipment of apparatus for the analysis of soils was shown alongside. The remaining exhibits in the central building call for no

[1] Extracts from the report of Mr. W. Fox, in Agricultural Bulletin of the Straits Settlements and Federated Malay States, Vol. VII, No. 11, November, 1908.

comment, being of such things as harness and saddlery, a few cases of tools, etc.

No. 1 avenue was devoted to agricultural implements used on estates, such as plows, various baskets and hand barrows for carrying tobacco leaves; levels, and road tracers and such like. Avenue No. 2 contained some most interesting agricultural produce. The lower half was occupied by the United Serdang Sumatra Rubber Plantation Company, who showed some excellent Liberian coffee in bulk, both in cherry and parchment, some bales of the tree cotton cleaned and uncleaned. The most interesting of their exhibits was the Rambong rubber. Arrangements had been made for a supply of latex and the processes of coagulating and washing were gone through. A 12-horsepower Campbell oil engine, and a Brown & Davidson washer were used for these purposes. Mr. V. Ris, the general manager, also gave an exhibition of tapping the Rambong, which contrary to the usual practice was in the herringbone style. I was informed that on one of their estates they had 30,000 trees each yielding about 1½ pounds of dry rubber, which sold at about 2 shillings 6 pence per pound, as against about 4 shillings 2 pence for fine Para. I noticed three Para rubber trees about 2 or 3 years old which had been pulled up by the roots; they were badly attacked by the Para rubber fungus, *Fomes semitostus,* and in conversation with Mr. Ris he stated that when a tree was discovered infected with it the trees should be destroyed for one-fourth of an acre round to stamp it out. The remaining portion of this avenue was for the most part occupied by Mr. L. A. Range, general manager of several estates, who showed Rambong in sheet form. Seeds of Para, Lagos, silk, and Rambong rubbers, ratans, *padi* in the ear, sugar from the sugar palm, gambier, tea, vanilla, wood specimens, and a brick-making machine completed this avenue. None of the last named were in any quantity, nor do they call for any special comment, except, perhaps in case of the vanilla pods, which were very good and show what can be done with this plant which is somewhat difficult to cultivate. The remaining avenues were taken up by exhibits of tradesmen, who showed almost every thing a planter could want in the way of tools and machinery for the estate. The models of estate buildings, such as drying and fermenting sheds, coolie lines, etc., were on a large and comprehensive scale. As regards the rest of the exhibition it consisted of an unrivaled collection of articles from the Battaks. The pottery, brass work, and gold thread cloth from Java, were also of an excellent description. The brush and basket work of the blind from the Bandoeng Institute, Java, was strong and serviceable.

I was informed that the entire exhibition cost between $50,000 and $60,000 of which the management hoped to get back about 50 per cent by gate money, etc., and judging by the crowds of natives that swarmed through the grounds, I think they did it. Ten thousand natives went through the barriers on Monday the 31st.

DELI.[1]

It is believed that the following sketch of the Province of Deli will interest our agriculturalists, more especially the tobacco growers of the islands.

Belawan.—On approaching Belawan, the harbor of Deli, the shore of Sumatra displays the same character as in the Banka Strait; a long, low, dark-green streak with a straight, unbroken line of coast stretching out into the muddy sea, while its upper edge, smooth and uniform, borders on the moist atmosphere, quivering with heat. It is only in the morning that we see, far inland, a ridge of dim blue mountains, from which rise a couple of finely delineated volcanic cones. One of these is distinguished by a greyish-yellow tint, which has gained for it, erroneously, the name of *Sulphur Mountain* and sometimes by a white plume of smoke hovering over its summit.

A broad stretch of lowland between the mountain range and the coast has been formed by the sinking of the mud washed away from the mountains at the mouths of the rivers and on both sides of their banks by the periodical inundations. The land is being continually increased by the woods along the coast, growing half into the sea, which consist almost entirely of mangrove or rhizophoræ trees (*bakoe*) standing above the water on a labyrinth of air roots, between which the mud remains hanging and accumulates. Thus the bottom of the sea, on which they take root, gradually becomes dry land, but underneath, along their outer edge a new fringe of young plants has come up which continue to form land.

Slowly and cautiously, the steamer creeps in over the mud-bank at the mouth of the river; often compelled to stop or run aground on the soft and continuously shifting bottom which the screw keeps sending up in dirty brown flakes. To the right and left, we see far out at sea, the nets of the Malay coast fishers.

Once over the bar, the boat can soon cast anchor in the spacious mouth of the Kwala Belawan, right opposite the station of the Deli Railway. Along the gangway we reach the pier, pass without much difficulty or loss of time, the custom-house, and with one of the many trains soon leave the damp, warm, and always very unhealthy harbor, and in a couple of hours reach the town of Medan.

Before arriving at Medan, we have already gained an impression of the characteristic scenery of Deli: a large, bare, monotonous surface, for the most part covered with high alang-alang grass—here called lalang[2]—or with wild, tangled shrubs; little inhabited, except where here and there a tobacco plantation lies in the midst of the fields. If we come at the time when the tobacco has been gathered in, then we see the greater part of these fields planted with rice, which the native population, according to their farm lease, may grow during the first year upon the fallow-lying tobacco fields. A few campongs with their fruit trees, and here and there a solitary *toealang* (bee-tree), which was spared when the primeval forest was rooted up, fail to break the monotony and desolateness of the scenery. On the contrary, they rather tend to increase it.

Near Medan we pass over an extensive railway embankment full of luggage trains and sheds, that gives one a lively impression of the commerce and prosperity which prevail in this tobacco country. The numerous crowds of native, or rather non-European travelers at every station, produce the same impression: Chinese, Malays, Javanese, Klingalese, Bengalese, and Battaks swarm on the quays and fill the numerous and spacious third-class carriages. The majority of these people

[1] From Van Bemmelen and Hooyer's "Netherlands India."

[2] Alang-alang, lalang, *Imperata arundinacea* is the common cogon grass of the Philippines.

come from other parts, for the original Malay population was, and is still, small. When the first tobacco planters came to Deli, the country was as thinly populated as the districts lying south and north of it on Sumatra's east coast.

So the planters were compelled to look for workmen elsewhere. The nearest place where coolies could be obtained was the Straits Settlements, which supplied Chinamen, who appear admirably adapted for the cultivation of tobacco. As, however, the prices of the English coolie brokers were exorbitantly high, the Deli Company contrived to effect a direct immigration from China. In smaller numbers there come to Deli, Javanese, Bewanese, Bandjarese, Klings (of the coast of Malabar), and Bengalese, the men of the last two races not, however, direct, but only from the Straits, and then, too, against the wishes of the English Indian Government.

All of the buildings and appurtenances of the railway look new and modern, which can easily be understood when we remember that the line was only laid down in 1886.

At Medan the line is divided into three branches: One to the left (on the east) runs to Serdang (Perbaoengan); the middle one, a continuation of the main line to Deli Toewa, on the slopes of the foot ridges of the mountain range; and the one to the right runs (in a northern direction) to Bindjei and Seleseh.

At Bindjei begins a narrow-gauge railway to Stabat on the Wampoe, in the direction of Tandjong-Poera (Klambir), constructed and worked by the Deli Company. When the tobacco is shipped, we see many wagons laden with neat bales of tobacco, packed in fine matting, but at all times the railroad yards are full of loads of imported articles, especially atap[1] (covering for roofs), and sticks for drying the tobacco (*anaq kajoe*), wood, uncut and cut, stones, chalk, ironwork, artificial manure, provisions, liquors, rice, and fish.

Medan, the chief place of Deli, electrically lighted, is the seat of the resident of the east coast of Sumatra, and of the Sultan. It lies on the Deli River at its confluence with the Boboera. As soon as we have stepped out of the station into the spacious aloen-aloen, we perceive at the first glance that we have arrived at a new, busy, and flourishing place. In 1869 it was chosen by Nienhuys, the originator of the Deli Company, as the seat of their chief administration on account of its adaptability for import and export. Before that time it was a wretched campong surrounded by a double wall, traces of which still remain.

What especially strikes the European coming from Java is the more modern Western character in the laying out of the grounds and buildings, the greater variety in architecture, adapted to the mixed population. The cause of this lies in the proximity of the Straits Settlements and the overwhelming influence of the planters, who form the chief element of the European colonists. These, of all nations, chiefly consisting of young enterprising men fresh from Europe, have imprinted a Western character upon everything, and in the arrangement of their dwellings and plantations have followed the examples of their English neighbors across the Straits, rather than those of Java, which lies farther off. In society we shall observe a closer connection with Europe, as the Deli tobacco planters travel more frequently to and from Europe than the Dutch settlers of Java, who still, to a great extent, keep up the old custom of remaining ten and even twenty years in the tropics.

The Deli Company.—This company has its chief office here. This, the largest and oldest of the many tobacco-cultivating companies, was established in 1869, and not long ago, celebrated its twenty-fifth year of existence. They then had 100,000 acres of land at their disposal, divided into twenty-one plantations in

[1] Atap, *Nipa fructicans* is the common nipa palm of the Philippines.

the Provinces of Deli and Langkat, and worked with a capital of 4.000,000 guilders and a reserve capital of four and a half millions. By their instrumentally, direct immigration of coolies from China was brought about; and by one of the members of their administration, a plan was devised by which the relations between the coolies and their masters were placed on a good and satisfactory basis.

That the Deli Company provides well for their workmen, is shown by their hospital and also their asylum for immigrants, which they built in connection with other planters. Here contract coolies, who by chronic or incurable diseases are unfit for work, find a temporary or permanent home.

Tobacco plantation.—Everywhere one will find the arrangements much the same:—In the middle a spacious house for the director, erected after the English-Indian bungalow type, rises high out of the ground. Next to it extends a gigantic fomenting barn to which the tobacco is taken in the month of July to lie and foment for from six to nine months upon piles which keep getting larger and higher, whilst beginning in September they are sorted by coolies who are seated in two long rows at the open sides; at the outside are the sorters and opposite them those that make up the bundles.

Then the large airy shed of the Chinese workmen, the so-called "kongsi," in the neighborhood of which one or more native shops, here named "kedei," are to be found, and other dwellings of Javanese, Klingalese or Boyans. Each of these races has its own peculiar labor; the Javanese are woodmen, roadmakers and gardeners; the Klingalese, cowherders and drivers of ox wagons (*kareta lemboe*); the Bengalese, policemen, and the Boyans, carpenters; whilst the clearing of the forest is done by Battaks and Malays, temporarily engaged, who can also build barns and make roads.

The tobacco fields are divided into from four to six groups over the extensive land of the plantation, of which every year only a tenth to a fifth part is used for tobacco growing. Each of these groups is under the superintendence of an assistant, who has under him about 100 workmen. On both sides of a plantation road are found the fields, which in January, February, and March are prepared for the reception of the young plants by the cutting down and burning of the trees and by working the soil with the "tjankol," or native spade. In April the "bibit," which has been sown on forcing beds, is planted out on it, which in July can develop into plants (tobacco trees) as high as a man. These are then cut down and taken to the drying sheds. The lofty, long sheds, with their gigantic roofs of 'atap,' are arranged in a long row by the high road, and are a characteristic of Deli scenery.

The fallow-lying fields may for a year be sown with rice by the population. After this time, they are left to themselves and are soon covered with a wilderness of bushes or else high alang-alang grass. The latter is getting too much the upper hand in Deli, principally owing to the burning down of the forests, which, either by accident or on purpose, are set on fire and can not grow again. The rewooding of land from which the tobacco has been gathered, is, therefore, one of the most difficult and important problems in Deli.

THE COUNTRY LIFE COMMISSION.

Some time ago President Roosevelt appointed Prof. L. H. Bailey, director of the agricultural college and experiment station for Cornell University; Mr. Gifford Pinchot, Chief of the United States Forestry Service, Washington, D. C.; Mr. Walter H. Page, editor of "Country Life in America;" President Kenyon L. Butterfield, of the Massachusetts Agricultural College, and Mr. Henry Wallace, editor of "The Wallace Farmer," in Iowa, as a commission to investigate the conditions of life on the farms of the country and to make recommendations as to the best ways and means by which farm life can be made more remunerative and attractive.

The commissioners held thirty public hearings among the people from forty different States and Territories, and have 120,000 answers to printed questions. The members of the commission have received nothing for their work on the commission and their service is an expression of public spirit which is a credit and, perhaps, one of the best resources any nation could have.

PRESIDENT ROOSEVELT'S MESSAGE.

On February 9 last, President Roosevelt submitted the report of the commission to Congress. The President's message commenting on the work of the commission is as follows:

I transmit herewith the report of the Commission on Country Life. At the outset I desire to point out that not a dollar of the public money has been paid to any commissioner for his work on the commission.

The report shows the general condition of farming life in the open country and points out its larger problems. It indicates ways in which the Government, National and State, may show the people how to solve some of these problems, and it suggests continuance of the work which the commission began.

METHODS OF THE COMMISSION.

Judging by thirty public hearings, to which farmers and farmers' wives from forty States and Territories came, and from 120,000 answers to printed questions sent out by the Department of Agriculture, the commission finds that the general level of country life is high compared with any preceding time or with any other land. If it has in recent years slipped down in some places, it has risen in more places. Its progress has been general, if not uniform.

Yet farming does not yield either the profit or the satisfaction that it ought to yield and may be made to yield. There is discontent in the country and in places discouragement. Farmers as a class do not magnify their calling and the movement to the towns though, I am happy to say, less than formerly is still strong.

HOW FARMERS CAN HELP THEMSELVES.

Under our system it is helpful to promote discussion of ways in which the people can help themselves. There are three main directions in which the farmers can help themselves, namely: I, *Better farming;* II, *better business;* III, *better living on the farm.*

The *National Department of Agriculture,* which has rendered services equaled by no other similar department in any other time or place; the *State departments of agriculture,* the *State colleges of agriculture and the mechanic arts,* especially through their extension work; the *State agricultural experiment stations,* the *Farmers' Union,* the *Grange,* the *agricultural press* and other similar agencies have all combined to place within the reach of the American farmer an amount and quality of agricultural information which if applied would enable him over large areas to double the production of the farm.

The object.—The object of the Commission on Country Life, therefore, is not to help the farmer raise better crops, but to call his attention to the opportunities for *better business* and *better living on the farm.* If country life is to become what it should be and what I believe it ultimately will be—one of the most dignified, desirable and sought after ways of earning a living—the farmer must take advantage not only of the agricultural knowledge which is at his disposal, but of the methods which have raised and continue to raise the standards of living and of intelligence in other callings.

Organization.—Those engaged in all other industrial and commercial callings have found it necessary under modern economic conditions to organize themselves for mutual advantage and for the protection of their own particular interests in relation to other interests.

The farmers of every progressive European country have realized this essential fact and have found in the coöperative system exactly the form of business combination they need.

Now, whatever the State may do toward improving the practice of agriculture, it is not within the sphere of any government to reorganize the farmers' business or reconstruct the social life of farming communities. It is, however, quite within its power to use its influence and the machinery of publicity which it can control for calling public attention to the needs and the facts. For example, it is the obvious duty of the Government to call the attention of farmers to the growing monopolization of water power. The farmers, above all, should have that power, on reasonable terms, for cheap transportation, for lighting their homes, and for innumerable uses in the daily tasks on the farm.

FARMERS' OWN COÖPERATION AND WORK NEEDED.

It would be idle to assert that life on the farm occupies as good a position in dignity, desirability, and business results as the farmers might easily give it if they chose. One of the chief difficulties is the failure of country life as it exists at present to satisfy the higher social and intellectual aspirations of country people. Whether the constant draining away of so much of the best elements in the rural population into the towns is due chiefly to this cause or to the superior business opportunities of city life may be open to question. But no one at all familiar with farm life throughout the United States can fail to recognize the necessity for building up the life of the farm upon its social as well as upon its productive side.

It is true that country life has improved greatly in attractiveness, health, and comfort and that the farmer's earnings are higher than they were. But city life is advancing even more rapidly because of the greater attention which is being

given by the citizens of the towns to their own betterment. For just this reason the introduction of effective agricultural coöperation throughout the United States is of the first importance. Where farmers are organized coöperatively they not only avail themselves much more readily of business opportunities and improved methods, but it is found that the organizations which bring them together in the work of their lives are used also for social and intellectual advancement.

The coöperative plan.—This is the best plan of organization wherever men have the right spirit to carry it out. Under this plan any business undertaking is managed by a committee. Every man has one vote and only one vote, and every one gets profits according to what he sells or buys or supplies. It develops individual responsibility and has a moral as well as a financial value over any other plan.

THE FARMERS' PROBLEMS THE WHOLE COUNTRY'S PROBLEMS.

I desire only to take counsel with the farmers as fellow-citizens. It is not the problem of the farmers alone that I am discussing with them, but a problem which affects every city as well as every farm in the country. It is a problem which the working farmers will have to solve for themselves, but it is a problem which also affects in only less degree all the rest of us, and therefore if we can render any help toward its solution it is not only our duty but our interest to do so.

The foregoing will, I hope, make it clear why I appointed a commission to consider problems of farm life which have hitherto had far too little attention and the neglect of which has not only held back life in the country, but also lowered the efficiency of the whole nation. The welfare of the farmer is of vital consequence to the welfare of the whole community. The strengthening of country life, therefore, is the strengthening of the whole nation.

The commission has tried to help the farmers to see clearly their own problem and to see it as a whole, to distinguish clearly between what the Government can do and what the farmers must do for themselves, and it wishes to bring not only the farmers, but the nation as a whole, to realize that the growing of crops, though an essential part, is only a part of country life. Crop growing is the essential foundation, but it is no less essential that the farmer should get an adequate return for what he grows, and it is no less essential—indeed, it is literally vital—that he and his wife and his children shall lead the right kind of life.

For this reason it is of the first importance that *the United States Department of Agriculture*, through which as prime agent the ideas the commission stands for must reach the people, *should become without delay, in fact, a department of country life*, fitted to deal not only with crops, but also with all larger aspects of life in the open country.

THREE NEEDS OF COUNTRY LIFE.

From all that has been done and learned three great general and immediate needs of country life stand out:

First. *Effective coöperation among farmers to put them on a level with the organized interests with which they do business.*

Second. *A new kind of schools in the country which shall teach the children as much outdoors as indoors and perhaps more, so that they will prepare for country life and not, as at present, mainly for life in town.*

Third. *Better means of communication, including good roads and a parcels post, which the country people are everywhere, and rightly, unanimous in demanding.*

To these may well be added *better sanitation, for easily preventable disease hold several million country people in the slavery of continuous ill health.*

ORGANIZATION NECESSARY.

The commission points out—and I concur in the conclusion—that the most important help that the Government, whether National or State, can give is to show the people how to go about these tasks of organization, education and communication with the best and quickest results. This can be done by the collection and spread of information. One community can thus be informed of what other communities have done and one country of what other countries have done. Such help by the people's government would lead to a comprehensive plan of organization, education, and communication and make the farming country better to live in, for intellectual and social reasons as well as for purely agricultural reasons.

The Government through the Department of Agriculture does not cultivate any man's farm for him, but it does put at his service useful knowledge that he would not otherwise get. In the same way the National and State governments might put into the people's hands the new and right knowledge of school work. The task of maintaining and developing the schools would remain, as now, with the people themselves.

MONEY FOR EXPENSES ASKED.

The only recommendation I submit is that an appropriation of $25,000 be provided to enable the commission to digest the material it has collected and to collect and to digest much more that is within its reach and thus complete its work. This would enable the commission to gather in the harvest of suggestion which is resulting from the discussion it has stirred up. The commissioners have served without compensation, and I do not recommend any appropriation for their services, but only for the expenses that will be required to finish the task that they have begun.

To improve our system of agriculture seems to me the most urgent of the tasks which lie before us. But it can not, in my judgment, be effected by measures which touch only the material and technical side of the subject. The whole business and life of the farmer must also be taken into account. Such consideration led me to appoint the commission on country life. Our object should be to help develop in the country community the great ideals of community life as well as of personal character. One of the most important adjuncts to this end must be the country church, and I invite your attention to what the commission says of the country church and of the need of an extension of such work as that of the Young Men's Christian Association in country communities. Let me lay special emphasis upon what the commission says at the very end of its report on personal ideals and local leadership. Everything resolves itself in the end into the question of personality. Neither society nor government can do much for country life unless there is a voluntary response in the personal ideals of the men and women who live in the country.

PLEA FOR FARMERS' WIVES.

In the development of character the home should be more important than the school or than society at large. When once the basic material needs have been met, high ideals may be quite independent of income, but they can not be realized without sufficient income to provide adequate foundation, and where the community at large is not financially prosperous it is impossible to develop a high average personal and community ideal. In short, the fundamental facts of human nature apply to men and women who live in the country just as they apply to men and women who live in the towns. Given a sufficient foundation of material well being, the influence of the farmers and farmers' wives on their children becomes

the factor of first importance in determining the attitude of the next generation toward farm life. The farmer should realize that the person who most needs consideration on the farm is his wife. I do not in the least mean that she should purchase ease at the expense of duty. Neither man nor woman is really happy or really useful save on condition of doing his or her duty. If the woman shirks her duty as housewife, as home keeper, as the mother whose prime function is to bear and rear a sufficient number of healthy children, then she is not entitled to our regard. But if she does her duty she is more entitled to our regard even than the man who does his duty and the man should show special consideration for her needs.

I warn my countrymen that the great progress made in city life is not a full measure of our civilization, for our civilization rests at bottom on the wholesomeness, the attractiveness and the completeness as well as the prosperity of life in the country. The men and women on the farm stand for what is fundamentally best and most needed in our American life. Upon the development of country life rests ultimately our ability, by methods of farming requiring the highest intelligence, to continue to feed and clothe the hungry nations, to supply the city with fresh blood, clean bodies and clear brains that can endure the terrific strain of modern life. We need the development of men in the open country, who will be in the future, as in the past, the stay and strength of the nation in time of war and its guiding and controlling spirit in time of peace.

SPECIAL RECOMMENDATIONS OF THE COMMISSION.[1]

The commission enumerates eleven specific suggestions for Congressional action that have been sent to it, such as *the encouragement of land surveys, the establishment of a highway engineering service* to be at the call of the States, and *the enlargement of the Bureau of Education;* it also groups remedies under the general term of *an educative campaign to spread information* on the whole subject of rural life, *to quicken the sense of responsibility for diversifying farming* so as to preserve soil fertility and improve rural society, *to make more widespread the belief in the necessity of organization, to make more general the farmer's sense of responsibility for the welfare of the farm laborer,* and *to awaken among the people generally conscience in protecting and developing natural scenery and the attractiveness of the open country.* There are, however, three great movements which the commission calls fundamental. These are worthy of quotation in full:

I. *Taking stock of country life.*—There should be organized, as explained in the main report, under the Government leadership, a comprehensive plan for an exhaustive study or survey of all the conditions that surround the business of farming and the people who live in the country, in order to take stock of our resources and to supply the farmer with local knowledge. Federal and State governments, agricultural colleges and other educational agencies, organizations of various types, and individual students of the problem, should be brought into coöperation for this great work of investigating with minute care all agricultural and country life conditions.

II. *Nationalized extension work.*—Each State college of agriculture should be empowered to organize as soon as practicable a complete department of college

[1] From the Outlook, February 20, 1909.

extension, so managed as to reach every person on the land in its State with both information and inspiration. The work should include such forms of extension teaching as lectures, bulletins, reading courses, correspondence courses, demonstration, and other means of reaching the people at home and on their farms. It should be designed to forward not only the business of agriculture, but sanitation, education, home-making, and all interests of country life.

III. *A campaign for rural progress.—We urge the holding of local, State, and even national conferences on rural progress*, designed to unite the interests of education, organization, and religion into one forward movement for the rebuilding of country life. *Rural teachers, librarians, clergymen, editors, physicians, and others may well unite with farmers in studying and discussing the rural question in all its aspects.* We must in some way unite all institutions, all organizations, all individuals having any interest in country life into one great campaign for rural progress.

The commission recognizes the great value of existing organizations such as libraries, agricultural societies, the Young Men's Christian Association, and, above all, the rural churches; and it urges the development of greater coöperation among them. It adds that there is a great call for leaders among farmers, rural teachers, and the rural clergy. The report and the message ought to have the widest circulation, not only among the dwellers in the country but even more especially among the people of the cities. It is the urban citizen who is in the greatest need of information on the subject; and he is in fact as much concerned with proper rural conditions as the man on the farm.

THE ANNUAL AGRI-HORTICULTURAL SHOW OF PERAK.[1]

A most successful agri-horticultural show took place at Kuala Kangsar in Perak, organized by an energetic committee, and had the advantage of patronage and help from his highness the Sultan of Perak and the British resident. The show was very representative of the best products of agriculture in Malaya, as well as native arts and crafts. It had an additional interest in being a more typical Malayan show than those held in towns of cosmopolitan character, and its success was to a great extent due to the efforts of Malayan gentlemen, especially the Dato Sri Adika Raja, I. S. O., and the Dato Stia Raja.

His excellency the high commissioner, who was in residence at Kuala Kangsar, performed the opening ceremony which was attended by their highnesses the Sultans of Perak, Johore, and Selangor. An interesting exhibition from Brunei of the characteristic metal work of that country was brought over by native chiefs escorted by Mr. Roberts, of the public works department.

These shows, especially when well attended as the Kuala Kangsar show was by large numbers of natives engaged in agricultural pursuits, spread the desire to improve different cultivations. At the same time they are of value to those engaged in helping the natives by allowing them to see in what direction help may best be given.

Seeds of prize fruits are obtained from the exhibitions and form a basis upon which the work of improvement of fruits by selection and other methods is carried on by the department.

Mr. T. W. Main,[2] superintendent of government plantations, Perak, speaking of the agri-horticultural show says:

> The agri-horticultural show was held at Kuala Kangsar on the 9th, 10th, and 11th of August. I acted as honorary secretary. The show was a great success and showed a profit of $712.28. These shows increase in excellence year by year. The quality of the exhibits was much in advance of those of former years. Perak exhibits were particularly good in rubber, fruit, and padi. Perak exhibitors carried off 150 first prizes, 125 seconds, and over 50 thirds, besides several silver cups, medals, and diplomas. The usual display of English vegetables from the Larut Hill Gardens was staged and attracted great attention.

[1] From the report of the director of agriculture, Federated Malay States, in agricultural bulletin of the Straits and Federated Malay States, Vol. VII, No. 11, November, 1908.

[2] Mr. T. W. Main, in annual report for 1907.

"All the principal industrial and social centers of the state are now approachable by good roads, and in most instances also by railway, and whether the traveler chooses to enter Perak by way of Penang from the north, Teluk Anson from the south, or Port Weld in the center, he will find facilities for passing rapidly and easily to almost any part of the state which he may desire to visit. Communication with Penang is maintained by steam ferry from that port to Prai in Province Wellesley, and thence by railway twice daily, and the vessels of the Straits Steamship Company run between Teluk Anson and Singapore about three times a week, touching en route at the ports of the southern states.

"The town of Kuala Kangsar, which is situated upon a most picturesque stretch of the Perak River, is the place of residence of his higness the Sultan, for whom an "astana" or palace of imposing appearance and dimensions was erected a few years ago at the cost of the state. He has since built two almost equally imposing structures out of his private purse." (From H. Conway Belfield's Handbook of the Federated Malay States.)

AGRICULTURAL CONDITIONS IN MARINDUQUE.

By A. F. Byars, *Agricultural Inspector.*

The Island of Marinduque, a subprovince of Tayabas, while only about one-third the size of Rhode Island, the smallest State in the Union, has almost as many geographical features as a continent. Her hills, mountains, rivers, plains, and bountiful natural resources offer opportunities for great agricultural development. In some of the mountains are found such minerals as lead, silver, and gold. Three Americans, who are at present engaged in mining in one of the barrios of Torrijos, claim to have discovered rich deposits of ore. The forests contain a large variety of fine cabinet woods which, while not found in very great quantities, are yet quite valuable.

As yet there are very few good roads in the island; but bancas and sailboats furnish easy transportation along the coast, while the port of Boac and the landlocked harbor of Santa Cruz offer good anchorages for steamers plying between Manila and southern ports.

Products and soils.—Generally speaking the soil of Marinduque—a shaley clayey loam on the mountains and hillsides, a black alluvial loam, calcareous sandy loam, or sand in the valleys and along the coast—is well adapted to the extensive growth of coconuts, abaca, rice, and numerous other crops of less importance. In Boac a large per cent of the cultivated land is planted to coconuts; in Torrijos to abaca, and in Gasan and Santa Cruz the areas of coconuts and abaca are about equal. (See map.) Considerable rice is grown in all four towns of Marinduque, but not enough for home consumption.

A few of the coconut trees are used for making "tuba," and a very small amount of the abaca is used in weaving "sinamay," a coarse native cloth; but copra and Manila hemp form by far the chief articles of export. The abaca is stripped, dried, and baled; most of the coconuts are made into copra and in some cases the oil is extracted before shipping. Anything that will increase the production of copra, abaca, and rice will add greatly to the wealth of the Island.

BETTER METHODS OF CULTIVATION NECESSARY.

COCONUTS.

Selection and care.—At present many of the groves are in a half-wild state; practically no care is given them until they begin to bear and then little more is done than to gather the nuts. Little thought is given to the improvement of the groves; trees are often less than 4 meters apart where a distance of 9 meters would almost double the yield. Some of the farmers have found the value of keeping their groves free from undergrowth and are burning the trash and giving their trees more room to spread. For best results only large well-matured thick-meated nuts should be planted. These nuts should be lowered to the ground by means of a rope, and not dropped from the tree, as the jar incurred by the fall weakens or kills the embryo plant. After remaining in the sprouting bed for five or six months only the strong healthy plants should be selected for transplanting to the place of permanent growth which should be previously prepared by thorough plowing. Young groves should be cultivated frequently to keep down weeds and retain moisture.

It is a good idea to plant some crop such as "camotes" or corn between the rows for the first two or three years. Even old groves should be cultivated once or twice each year.

Enemies.—As a preventative to the spread of disease and injurious insects nothing equals the cutting down of all dead and dying trees and the collecting in heaps of all dead trunks, leaves, and trash and burning them. These things offer most advantageous places for the breeding of insects and plant diseases. A close watch in the groves for the rhinoceros beetle (*uang*), which bores its way into the bud, will be the means of saving many trees. This insect should be removed from its hole by means of a piece of pointed wire having a barb, or killed by pouring carbon bisulphide into the hole and closing it up with mud. Occasionally the base of the leaves should be cleaned of all collected trash so as to keep out rats. Some means should be devised for destroying the crow (*whac*), which has become quite a pest in this island and destroys large quantities of young nuts, also corn and other crops. Use of poisoned bait would probably be the most effective means of ridding the country of these pests. A practice prejudicial to the groves is that of cutting notches or steps in the trunks of the trees as these places are very susceptible to the attacks of insects and fungous diseases. It would be better to detach the nuts by means of a curved knife fastened to the end of a sectioned bamboo pole as is practiced in the Province of La Laguna.

ABACA.

Selection and stripping.—At times like this, when the price is very low, only those varieties of abaca which yield the best fiber should be

PLATE I. MAP OF THE ISLAND OF MARINDUQUE SHOWING DISTRIBUTION OF AGRICULTURAL PRODUCTS.

grown. Of the crop that has been gathered during the past several months in the municipality of Gasan 10 per cent or less was first-class hemp; about 50 per cent was second-class and 20 to 30 per cent was third-class. By a continued and careful selection of sprouts from the best stalks when transplanting a variety could be produced which would yield a much higher percentage of first-class fiber. One of the practices that lowers the selling price of a sample of hemp more than anything else is that of failing to carefully and properly strip and clean the fiber. Not only should the fiber be strong, long, and white, but it should be thoroughly cleaned.

There are many uncultivated areas around the towns of Gasan and Torrijos that could be profitably planted to abaca. In these sections it does well where a little care and cultivation is given. It grows well on the stony hill and mountain sides which are too rough for any other crop.

RICE AND OTHER FOOD CROPS.

The most vulnerable point in the agricultural practices of Marinduque, in fact of a great part of the whole Philippine Archipelago, is its failure to produce sufficient food crops. This deficiency is not due to lack of fertile soils, favorable climatic conditions, or to a scarcity of food plants which thrive. The people have not yet learned the value of a diversification of crops. With the development of irrigation facilities, afforded by the several mountain streams and proper cultivation, enormous crops of rice could be produced in the fertile valleys. A perfected system of irrigation would make possible two crops of rice each year over a large area.

CORN.

Considerable quantities of corn are now grown on the "Tres Reyes" islands off the southwest coast. Corn could be produced more extensively in Marinduque—a crop of corn being raised after a crop of rice during the dry season.

CACAO.

In nearly every barrio a few cacao trees are grown. These seem to be remarkably free from insects and diseases and there is no doubt but what cacao could be made an export crop of the island.

VEGETABLES.

Sweet potatoes do well in Marinduque and this crop could be easily increased. Several varieties of peas, two kinds of squashes, peppers (which grow wild everywhere), tomatoes, onions, and other vegetables are to be found growing all over the island, and an ample quantity of all of these could be produced for domestic use.

FRUITS.

Mangoes, bananas, oranges, chicos, duhats, and innumerable other fruits, now growing half wild, could with cultivation and selection be greatly improved.

STOCK RAISING.

The hillsides around Santa Cruz and Torrijos are admirably suited to stock raising, having grass all the year round and an abundant supply of fresh water. However, more care should be given to breeding—only the best animals should be used for this purpose.

Until the inhabitants learn the full meaning of the word *quarantine* in regard to infectious and contagious animal diseases they can not succeed in this industry. It would be well for the provincial board to pass a rigid quarantine law and enforce it; until this has been done no veterinarian can hope to stop the depredations of surra and rinderpest.

In conclusion, the Island of Marinduque is, indeed, rich in natural resources, including a fertile soil, abundant water supply, forests of valuable woods, and climatic conditions favorable to the growth of varied crops. With intelligent cultivation of her soil the employment of scientific methods of crop cultivation and the building of good roads, Marinduque can be made to blossom like a garden.

AN ORDINANCE TO PREVENT THE INTRODUCTION OF PLANT PESTS INTO THE STRAITS SETTLEMENTS.[1]

Nearly all of the colonies especially those of the tropics now have regulations as to the importation of plants or seeds from countries in which there is any insect or plant pest affecting plants, through which the disease is likely to be introduced. These regulations are intended of course to protect cultivated plants only and are usually, but not always, enforced when there is a definite disease affecting an extensive cultivation in the country of the would-be exporter, and the same cultivation is without the disease in the country to which it is intended to export the plant. Thus Jamaica for many years prohibited the importation of any living plants of whatever kind from any country, in which there was cultivated coffee affected with *Hemileia vastatrix,* and thus kept the disease out of the country for a considerable period. There are diseases which no man can possibly prevent the invasion of as the distances which spores of fungi can float on the wind is very great and in countries at all contiguous they can drift across if the wind is suitable. The bee-hawk moth, the caterpillar of which was so destructive to the coffee some years ago in Selangor, is also a very long-flying insect. It was found to be quite abundant in Christmas Island over 200 miles from the nearest land it could have come from.

But these are rather exceptional cases and most plant diseases appear to be accidentally imported by man. In the interest therefore of the great areas of cultivations of plants nowadays, it is essential to prevent as much as possible any disease that has unfortunately appeared in one country from invading another.

Hitherto there has been no ordinance permitting the colony to refuse to allow diseased plants to be imported, and it became clearly desirable that it should have this power. Hence at the suggestion of the director of gardens the following ordinance has been passed.

[Straits Settlements Ordinance No. XII, 1908.]

An ordinance to prevent the introduction into the colony of pests and insects destructive to trees, plants and crops.

It is hereby enacted by the governor of the Straits Settlements with the advice and consent of the legislature thereof as follows:

1. This ordinance may be cited as "The Destructive Pests Ordinance 1908."

2. The governor in council may from time to time make such orders as may to the governor in council appear expedient for preventing the introduction into

[1] Agricultural Bulletin of the Straits and Federated Malay States. Vol. VII, No. 12, December, 1908.

the colony of any insect, fungus, or other pest, destructive to agricultural or horticultural crops, to trees or plants, and for preventing the spreading in the colony of any such insect, fungus, or other pest.

3. Any such order may prohibit or regulate the landing in the colony of any tree or plant, or the leaves, branches, stems, roots, seeds, or fruit of any tree or plant, or any vegetable substance or other article, the landing whereof may appear to the governor in council to be likely to introduce such insect, fungus, or other pest, and may direct or authorize the treatment or destruction of any such article, if landed. Any such order may also direct or authorize the treatment, removal, or destruction of any crop, tree, plant, or substance on which the insect, fungus, or other pest in any stage of its existence is found, or by means of which it may appear to the governor in council to be likely to spread, and the entering on any lands for the purpose of such treatment, removal, or destruction, or for the purpose of any examination or inquiry authorized by the order, or for any other purpose of the order.

4. The governor in council may from time to time make orders for the payment of compensation in respect of any crop, tree, plant, or other substance destroyed under the provisions of this ordinance.

5. Any person acting in contravention of any order under this ordinance shall be guilty of an offense, and shall be liable upon conviction to a fine not exceeding five hundred dollars.

Passed this 11th day of September, 1908.

EXTRACT FROM THE REPORT OF THE GOVERNMENT ENTOMOLOGIST, HAWAII, FOR NOVEMBER AND DECEMBER, 1908.[1]

INSPECTION.

We boarded 55 vessels and found matter subject to our inspection on 34 of them. The result is shown briefly in the following table.

Table of inspection.

Disposal with principal causes.	Lots.	Parcels.
November:		
Passed as free from pests	569	13,150
Fumigated for scale bugs and white fly before releasing[a]	13	24
Ordered potatoes returned on account of scab	2	298
Ordered apples and pears returned on account of greedy scale	3	532
Burned on account of scale and rot	2	2
Burned turnips and horse-radish roots on account of cabbage maggot	2	4
Burned fruit from the Orient because prohibited by your regulation	14	17
Burned taro, sweet potatoes, and garlic from the Orient because of parasitic fungus on first and insect pests on last two	3	10
Total	608	14,037
December:		
Passed as free from pests	759	16,439
Fumigated for large variety of mealy and scale bugs, white fly and evidence of borer	15	41
Mangroves from Manila picked over one by one for a variety of most dangerous pests, then fumigated before releasing	1	3
Bamboo plants from Japan treated likewise	1	1
Seed potatoes treated with formalin to kill scab	1	35
Potatoes ordered returned on account of scab and soil	7	813
Apples ordered returned on account of greedy scale	2	115
Burned for a variety of pests	7	13
Total	793	17,460

[a] One of these was a wardian case of mango plants from Honolulu bound for another island. To prevent spread of possible pests fumigated at request of shipper.

MISCELLANEOUS.

Dock laboratory and quarantine room.—The laboratory on the Oceanic dock was completed early in December and is a credit to the service, which it aids in a decidedly substantial way. We had repeated occasion to use it to advantage and with success. We also have there now a sign proclaiming to the world the mission of those structures on the dock.

Fumigatory exhaust.—Hitherto, in order to ventilate the fumigatories the doors were opened and the gases discharged directly onto the dock. This was dangerous to the operators, and other people also when operated on steamer days. An appeal was made to the superintendent of public works and he kindly had a 4-inch gate-valve and necessary piping put in, enabling us to exhaust the noxious fumes outside and above the dock. This was installed on the Oceanic Dock.

[1] The Hawaiian Forester and Agriculturist, Vol. VI, No. 1, January, 1909.

REPORT ON RICE CULTIVATION IN ZAMBALES AND PANGASINAN.

By Silverio Apostol, *Agricultural Assistant.*

Samples were gathered in that part of Pangasinan east of the railroad line, namely, from the towns of Villasis, Asingan, Tayug, San Quintin, Binalonan, and Pozorrubio. This section of the province is generally flat and low, and rice is practically the only crop grown in appreciable quantities. A little tobacco is also cultivated, especially in the municipalities of Manaoag, San Jacinto, and Mangaldan. Following the rice crop in Asingan about 70 per cent of the total area from which rice is harvested is planted with a kind of bean known as "mongo." Asingan, it may be noted, is the best irrigated of all of the towns in this section and it is said that about 70 per cent of all of the rice lands therein do not have to depend very much on rainfall for water. The mongo is grown after the rice crop during the latter half of February or early in March.

SELECTION.

Apparently the farmers of Pangasinan and those of Zambales have different ideas in making their selection of rice seed. The rice grown in Zambales is mostly awnless, while in Pangasinan awned rice is grown almost exclusively and there is comparatively little awnless rice raised except for feeding chickens. Thus the expense and work of thrashing awnless rice is avoided in Pangasinan; harvesting awned rice, however, demands more labor, as the process of cutting it is very tedious.

Awned rice shatters or shells less easily than the awnless varieties. Besides, the threshing is done by animals (carabaos, cattle, or horses) tramping off the grain, and the presence of the awn or beard, which hurts the feet of the animals, makes threshing more difficult.

METHOD OF CULTIVATION.

The method employed in growing rice in Pangasinan is practically the same as that used in Zambales, La Laguna, and other parts of the Islands.

Lowland rice.—In the absence of artificial irrigation, the work is begun with the advent of the rainy season. During the latter part of April and the whole of May the seed beds are prepared and from the last half of July through the first half of September, the transplanting is done. The ground for the seed bed is plowed and harrowed three or

four times until the soil is pulverized enough for good germination. It is then divided into plots by running the plow deeply at intervals of about eight feet, after which the seed is sown rather thickly and covered thinly with soil from the edges of the plots.

The above method of seeding is practiced more in Zambales than in Pangasinan, as in the latter province the farmers choose a higher place for their seed beds and drill the seed instead of sowing it. Three men are generally necessary to do the work; one man with a large toothed instrument like a wooden fork makes the holes, and two men follow him to distribute the seed, leaving from twenty to forty grains in each hole. The holes made by the teeth of this instrument are $3\frac{1}{2}$ to 4 inches apart, 3 inches deep, and about $1\frac{1}{2}$ inches in diameter.

TRANSPLANTING.

When the seed acquires a height of about 17 inches, at which time it is about five weeks old, rain or water being sufficient, it is pulled up carefully and after washing off the adhering soil it is transplanted to a field which has been previously plowed once and harrowed. Generally, the harrowing is partly done the day before, and partly on the day of transplanting, by hand. One, two, or three of the young plants make a hill. The base or root is introduced into the mud by the thumb and first finger, and left there. The hills are about 8 inches apart. The Ilocanos use a short pointed stick to assist in making the hole for the young plant. Having transplanted his rice, the farmer generally leaves the rest to Divine Providence, doing nothing more—often not even inspecting it—until the time of harvest. If he gathers a poor crop, he sadly satisfies himself by saying, "Oh, I have bad luck this year!"

Highland rice.—The land is plowed once in April and again in May; after it has been rolled and harrowed the seed is sown broadcast. No further cultivation or weeding is done to the growing crop before harvesting.

Where the land can not be plowed it is cleared of bushes and small trees with the help of fire, and the seed is then drilled in by means of sharpened or pointed sticks, with which one man makes little holes in the ground and another follows him with the seed, leaving from one to six grains in each hole.

Evidently, the cost of growing highland rice is much less than that of growing the lowland varieties.

HARVESTING.

Harvesting awned rice, as previously stated, is a very tedious process. The spikes are cut off one by one, with a hand instrument consisting of a handle and blade, about 10 or 12 inches below the lowest whorl or spikelet. The spikes are then tied up with twine into bundles about $3\frac{1}{4}$ inches in diameter. One person generally cuts an average of from 28

to 36 bundles per day, about 5 or 6 "manojos." One "manojo" weighs from 25 to 32 pounds when dry. The harvesting is done on shares and generally one-fifth goes to the harvester. One hectare of the average rice land of Pangasinan produces normally about 135 "manojos" of rice.

COST OF PRODUCTION.

The cost for farm labor, especially transplanters, varies from 20 centavos to 50 centavos per day, while that for one man with a carabao and a plow or harrow varies from 50 centavos to ₱1.50 per day. It is customary in Pangasinan for the owner to provide breakfast and dinner for the workers whenever the work involves one day's labor. In the case of harvesting on shares the harvester furnishes his own meals. It takes from five to seven men to plow one hectare of land, it requires about six "manojos" of seed, ten to twelve persons to transplant, and thirty to thirty-five to harvest the crop in one day. Generally, the growing of one hectare of lowland rice in Pangasinan, exclusive of harvesting, involves an average expense of about ₱22.50.

VARIETIES RAISED IN PANGASINAN.

According to the reports received by the Bureau of Agriculture there were 17,000 hectares of land in Zambales devoted to rice raising which produced 567,000 cavans of rice in 1908. In response to the request of the Director of Agriculture the following varieties of rice have thus far been reported from the towns named in Pangasinan:

Table showing varieties of rice grown in Pangasinan.

Towns in Pangasinan and varieties in order of their importance.	Highland (H) or lowland (L).	Glutinous (G) or nonglutinous (NG).	Bearded (B) or not bearded (NB).	Color of cuticle.	Days to maturity.	
					From sowing.	From transplanting.
Santa María:						
Caviteña	L	NG	B	White	180	150
Mimis	L	G	NB	do	180	150
Presentado	L	G	B	do	120	90
Sambilak	L	NG	B	do	150	120
Macaanay	L	NG	B	do	210	180
Macanista	L	G	B	do	215	180
Buric	L	NG	B	do	180	150
Guinguin-awa	L	NG	B	do	150	120
Binacroy	L	NG	B	do	180	150
Mabolo	L	NG	B	Red	180	150
Cayading	L	G	B	White	180	150
Binalayang	L	NG	B	do	180	150
Matayosa	L	NG	B	do	215	180
Ganado	L	NG	B	do	215	180
Bal-latinew	L	NG	B	Black	210	180
Bul-lilising	L	NG	B	White	210	180
Melmel	L	NG	B	do	310	280
Murmuray	L	NG	B	do	240	210
Linagat	L	NG	B	do	210	180
Mambog	L	NG	B	do	210	180
Minantica	L	NG	B	do	210	180
Pallacate	L	NG	B	do	210	180
Candelaria	L	NG	B	do	210	180
Moñosa	L	NG	B	do	210	180
Pinili	L	NG	B	do	210	180
Quinastila	L	NG	B	do	210	180
Ortao	L	NG	B	do	210	180
Almisque	L	NG	B	do	220	190

Table showing varieties of rice grown in Pangasinan—Continued.

Towns in Pangasinan and varieties in order of their importance.	Highland (H) or lowland (L).	Glutinous (G) or non-glutinous (NG).	Bearded (B) or not bearded (NB).	Color of cuticle.	Days to maturity.	
					From sowing.	From transplanting.
Calasiao:						
Caviteña	H	NG	B	White	110	
Macarañag	H	NG	B	do	90	
Binondoc	H	NG	B	do	100	
Macunting	H	NG	B	do	100	
Quinaturay	H	NG	B	do	100	
Binoloney	H	NG	NB	Red	110	
Malinis	H	NG	NB	White	110	
Magamang	H	NG	B	Red	110	
Pinili	L	NG	B	White	140	100
Damasco	L	NG	B	do	120	90
Saruyao	L	NG	B	do	120	90
Ubanan	L	NG	B	do	120	90
Salayusay	L	NG	B	do	120	90
Limpulet	L	NG	B	do	140	100
Binolalaqui	L	NG	B	do	140	100
Aculao	L	NG	B	Red	110	80
Goyoran	L	G	B	White	110	80
Binotayon	L	G	NB	do	110	80
Nilangca	L	G	B	do	120	90
Binmaley:						
Caviteña	H	NG	B	Red	270	180
Ubanen	H	NG	B	White	270	180
Magonting	H	NG	B	do	270	180
Batalinew	H	NG	B	Brown	270	180
Pinaculat	H	NG	B	White	270	180
Maneclang	H	NG	B	Red	270	180
Saba	H	NG	B	White	270	180
Salayosay	H	NG	B	do	270	180
Linarocot	H	NG	B	do	270	180
Ansaquet	H	G	B	Brown	270	180
Santa Barbara:						
Ubanan	H	NG	B	White	140	110
Binalalaqui	H	NG	B	do	145	115
Caviteña	H	NG	B	Red	130	100
Macarañag	H	NG	B	White	75	130
Malinío	H	NG	NB	do	80	
Mismis	L	NG	B	do	160	130
Sipit	L	NG	B	do	142	112
Quinatoray	H	NG	B	do	60	
Bangol	H	NG	B	do	65	
Lamparan	H	NG	B	do	65	
Calaguiquing	H	G	B	do	65	
Inagamang	H	G	B	do	70	
Binondoc	H	NG	B	do	70	
Malingao	H	NG	B	do	70	
Brea	L	G	NB	do	110	80
Caclumba	L	NG	B	do	115	85
Daloson	L	NG	B	do	120	90
Sambilar	L	G	B	Red	120	90
Matanorang	L	NG	B	Reddish-white.	130	100
Minaloco	L	NG	B	White	130	100
Bansoroy	L	NG	B	do	130	100
Macalonit	L	NG	B	do	130	100
Binolaney	L	NG	NB	do	130	100
Sinoan	L	G	B	do	135	105
Batolinew	L	G	B	Red	130	100
Berico	L	NG	B	White	140	110
San Vicente	L	NG	B	do	140	110
Linaclang	L	NG	B	do	140	110
Corrales	L	G	B	Red	140	110
Simpolet	L	NG	B	White	142	112
Cayabang	L	NG	B	do	142	112
Salayosay	L	NG	B	do	142	112
Minantica	L	NG	B	do	142	112
Labong	L	G	B	do	142	112
Quinastila	L	NG	B	do	145	115
Binara	L	NG	B	do	145	115
Acolao	L	G	B	do	145	115
Sinullá	L	G	B	do	145	115
Piñas	L	NG	B	do	155	125
Boncol	L	NG	B	do	160	130

Table showing varieties of rice grown in Pangasinan—Continued.

Towns in Pangasinan and varieties in order of their importance.	Highland (H) or lowland (L).	Glutinous (G) or non-glutinous (NG).	Bearded (B) or not bearded (NB).	Color of cuticle.	Days to maturity.	
					From sowing.	From transplanting.
San Nicolás:						
Pinili	H	NG	B	White	110	
Ganado	L	NG	B	do	200	170
Obanan	L	NG	B	do	160	130
Mandigorin	L	NG	B	do	180	150
Melmel	L	NG	B	do	210	180
Candelaria	L	NG	B	do	220	190
Calantangan	L	NG	B	do	210	180
Mormoray	L	NG	B	do	210	180
Banata	L	NG	B	do	210	180
Principe	L	NG	B	do	200	190
Manteca	L	NG	B	do	180	150
Cayaring	L	NG	B	do	180	150
Boncol	L	NG	B	do	110	150
Almisqui	L	NG	B	do	200	190
Dalosón	L	NG	B	do	200	190
Enero	L	G	B	do	200	190
Ortoc	L	NG	NB	do	180	150
Mambog	L	NG	B	do	180	150
Mabolo	L	NG	B	Red	150	120
Macanini	L	G	B	White	150	120
Castaño	L	G	B	do	150	120
Mimis	L	NG	NB	do	150	120
Lanca	L	NG	B	do	150	120
Impon	L	NG	B	do	150	120
Bal-lilising	L	G	B	do	150	120
Batolinew	L	G	B	Red	150	120
Bayabas	L	G	NB	White	150	120
Sinaba	H	G	B	do	110	
Bolic	H	NG	B	do	110	
Catoray	H		B	do	110	
Calangiquing	H	G	B	do	110	
Bangol	H	NG	B	do	110	
Cosimay	L	NG	B	do	180	150
Bani:						
Ganado	L	G	B	do	240	150
Castila	L	NG	B	do	240	150
Mantica	L	G	B	do	240	150
Bandera	L	NG	B	do	240	150
Mantenido	L	G	B	do	240	150
Macaranag	L	G	B	do	240	150
Payapay	L	G	B	do	240	150
Capigued	L	NG	B	Red	210	150
Baticang	L	NG	B	White	210	150
San Juan	L	G	B	do	210	120
Bansoroy	L	NG	B	do	210	120
Quiriquiri	L	NG	NB	do	210	120
Macan dingay	L	G	B	do	240	120
Bul-lilising	L	G	B	do	210	120
Castañeda	L	G	B	do	210	120
Batalinew	L	G	B	Black	210	120
Ibali	L	G	NB	White	210	120
Sinampablo	L	G	NB	do	210	120
Balasang	L	G	B	do	240	150
Bangrae	L	NG	B	do	240	150
Grana	L	NG	B	Red	240	150
Binada	L	NG	B	White	240	150
Balayang	L	NG	B	do	240	150
Sal-laguid	L	NG	B	do	240	150
Salayusay	L	NG	B	do	240	150
Azucena	L	NG	B	do	240	150
Caviteña	L	NG	B	do	240	150
Mapursac	L	NG	B	do	240	150
Santa Cruz	L	NG	B	do	240	150
San Fabian:						
Pinili	L	NG	B	do	195	165
Sambilac	L	NG	B	do	195	165
Malaca	L	NG	B	do	195	168
Cristal	L	NG	B	do	195	165
Ubanen	L	G	B	do	195	165
Quinaballero	L	NG	B	do	195	165
Mambog	L	NG	B	do	150	110
Tayaring	L	NG	B	do	150	110
Batolinew	L	G	B	Red	150	110
Mariquet	L	G	B	White	150	110
Romero	L	NG	NB	do	150	110

Table showing varieties of rice grown in Pangasinan—Continued.

Towns in Pangasinan and varieties in order of their importance.	Highland (H) or lowland (L).	Glutinous (G) or non-glutinous (NG).	Bearded (B) or not bearded (NB).	Color of cuticle.	Days to maturity.	
					From sowing.	From transplanting.
San Fabian—Continued.						
Oldog	L	NG	NB	White	150	110
Bolic	H	NG	B	do	100	60
Rosquitis	H	NG	B	Red	100	60
Payos	H	NG	B	do	100	60
Sinamvicente	H	NG	B	do	100	60
Grana	H	NG	B	do	100	60
Anda:						
Coliit	H	NG	B	White	180	
Amigay	H	NG	B	do	180	
Matayosa	L	NG	B	do	210	180
Quiriquiri	L		NB	do	210	180
Isla	H		B	do	180	
Macoloney	L		B	do	210	180
Binangar	L		B	do	210	180
Bangos	L		B	do	210	180
Bandera	L		B	do	210	180
Marilis	L		B	Red	210	180
Bacnotan	L		B	White	210	180
San Carlos:						
Momalit	H	NG	B	do	240	210
Mantica	H	NG	B	do	240	210
Binacloy	H	NG	B	do	240	210
Payapang	H	NG	B	do	240	210
Ganado	H	NG	B	do	240	210
Malaca	H	NG	B	do	240	210
Principe	H	NG	B	do	240	210
Sagat	H	NG	B	do	240	210
Quinastila	H	NG	B	do	240	210
Caviteña	H	NG	B	do	180	150
Castaño	H	NG	B	do	180	150
Inanteresa	H	NG	B	do	180	150
Sambilac	H	NG	B	do	180	150
Sinarocot	H	NG	B	do	180	150
Salayusay	H	NG	B	Red	180	150
Macansuana	H	NG	B	White	180	150
Romero	H	NG	B	do	180	150
Binondoc	H	NG	B	do	160	130
Malogtoc	H	NG	B	do	160	130
Macatlong bulan	H	NG	B	do	160	130
Casibong	H	G	B	do	180	150
Condiman	H	G	B	do	180	150
Goyoran	H	G	B	do	180	150
Bria	H	G	NB	do	180	150
Batayong	H	G	NB	do	180	150
Natividad:						
Pinili	H	NG	B	do	90	
Sampadon	H	NG	B	do	90	
Macanene	L	NG	B	do		120
Macan	L	NG	B	Red		120
Sambilac	L	NG	B	do		120
Mambog	L	NG	B	White		120
Bal-latinao	L	G	B	Red		120
Candelaria	L	NG	B	White		180
Bongeol	L	NG	B	do		180
Ortoc	L	NG	NB	do		120
Calangiquin	L	G	B	do		120
Seda	L	NG	B	do		120
Bul-lilising	L	G	B	do		120
Ubanan	L	NG	B	do		180
Melmel	L	NG	B	do		180
Binalonan:						
Murmuray	L	NG	B	do	240	200
Pias	L	NG	B	do	240	200
Diquet a lacay	L	G	B	do	240	200
Batnang	L	NG	B	do	240	200
Autonia	L	NG	B	do	240	200
Contenido	L	NG	B	do	240	200
Ubanan	H	NG	B	do	195	
Ganado	H	NG	B	do	210	
Matayosa	H	NG	B	do	210	
Saba	H	NG	B	do	80	
Catlonbulan	H	NG	B	do	90	
Macapno	H	NG	B	do	180	
Sobacosac	H	NG	B	do	180	
Quinatoday	H	NG	B	do	180	

Table showing varieties of rice grown in Pangasinan—Continued.

Towns in Pangasinan and varieties in order of their importance.	Highland (H) or lowland (L).	Glutinous (G) or non-glutinous (NG).	Bearded (B) or not bearded (NB).	Color of cuticle.	Days to maturity.	
					From sowing.	From transplanting.
Binalonan—Continued.						
Castaño	H	NG	B	White	195	
Ortoc	H	G	NB	do	195	
Bul-liliseng	H	G	B	do	195	
Sambilac	H	NG	B	Red	195	
Mimis	H	NG	B	White	195	
Macaanay	H	NG	B	do	195	
Binaroy	H	NG	B	do	195	
Seda	H	G	B	do	195	
Ballatinao	H	G	B	Red	195	
Cayading	H	G	B	White	210	
Capigued	H	G	B	do	210	
Bongcol	H	G	B	do	210	
Mendegurin	H	G	B	do	210	
Urbiztondo:						
Balolaqui	L	NG	B	do	140	
Mantica	L	NG	B	do	160	
Inomalit	L	NG	B	Red	140	
Malaca	L	NG	B	White	140	
Princesa	L	NG	B	do	140	
Romero	L	NG	NB	do	140	
Goyoran	L	G	B	Black	140	
Batalinew	L	G	B	do	140	
Alasan	L	G	B	Red	120	
Bato	L	G	NB	Black	120	
Inagamang	H	NG	B		120	
Caviteña	H	NG	B	White	120	
Magano	H	NG	B	do	120	
Bolu	H	NG	B		120	
Sambilac	H	NG	B	Red	120	
Alcala:						
Ganado	L	NG	NB	White	180	150
Matayosa	L	NG	NB	do	210	180
Payos	L	NG	NB	do	210	180
Princesa	L	NG	B	do	210	180
Castaño	L	NG	B	do	210	180
Ubanen	L	NG	B	do	210	180
Bul-lilising	L	NG	B	do	210	180
Binacal	L	NG	B	do	210	180
Caviteña	H	NG	B	do	150	
Ortoc	L	NG	NB	do	150	120
Quinatuday	H	NG	NB	do	180	
Mangasa	H	NG	NB	do	120	
Malaca	L	NG	B	do	210	180
Mantica	L	NG	B	do	180	150
Bal-lalinao	L	G	B	Red	180	150
Mimis	L	NG	NB	White	180	150
Binacroy	L	NG	NB	do	180	150
Daldal	L	NG	B	Red	150	120

BALANCE SHEET OF THE SELANGOR AGRI-HORTICULTURAL SHOW, 1908.

OFFICE OF SUPERINTENDENT OF
EXPERIMENT PLANTATIONS, FEDERATED MALAY STATES,
Kuala Lumpor, November 19, 1908.

SIR: I have the honor to forward herewith balance sheet of the agri-horticultural show held in Kuala Lumpor on the 10th, 11th, and 12th of August last.

I have the honor to be, sir, your obedient servant,

J. W. CAMPBELL,
Hon. Secretary, Agri-Horticultural Show.

Balance sheet.

RECEIPTS.		EXPENDITURES.	
Subscription, Federated Malay States government contribution	$2,000.00	Prizes, cups, and medals	$731.86
Subscription, Straits Settlements government contribution	2,000.00	Money awards	1,845.00
Subscription, private	3,342.00	Printing and advertising	391.77
Subscription for special prizes	533.37	Transport	262.72
Gate receipts	1,549.85	Band	25.00
Rent for trade space and bar	465.00	Gate expenses	131.40
Receipts from visitors	453.82	Postage and telegrams	51.31
Proceeds of sale of buildings	242.62	Expenses of housing visitors	687.75
		Cost of buildings and fencing	3,667.15
		Miscellaneous clerical services	66.00
		Miscellaneous coolies wages	52.75
		Miscellaneous petty expenses	346.57
		Balance in bank	2,327.40
Total	10,586.66	Total	10,586.66

EXTRACTS FROM THE REPORT OF THE DIRECTOR OF AGRICULTURE FOR THE FEDERATED MALAY STATES, 1907.[1]

The report of the third year's work of the department of agriculture in the Federated Malay States records progress made in various directions.

Libraries and Laboratories.—The arrangement and fitting of laboratories, library, and offices naturally occupied some time, and the government mycologist began the arranging and cataloguing of the books and pamphlets in the library. Much time is lost in answering inquiries or making investigations by the absence of a comprehensive catalogue which enables any notes on a technical subject to be found at once without searching through various books or pamphlets where the information is most likely to be found. The card catalogue system universally found to be best for such libraries has been adopted.

Government Mycologist.—Mr. W. J. Gallagher, the government mycologist, took up his appointment on the 4th of April. He devoted himself at first to arranging and cataloguing the library and making himself familiar with the botanical and agricultural conditions of the Federated Malay States. The appointment of a scientific man to devote himself to the study of the diseases of cultivated plants is one of the best forms of insurance of agricultural interest which can be adopted.

That such an official can at once produce a panacea for all or any diseases which are causing damage to the various cultivated plants of the country no one will expect, but that all diseases can be looked after from their earliest stages and studied *in situ*—the only way in which any knowledge can be gained—is of great value. The history of such work has shown that the investigation of diseases of plants has always led to methods being discovered for successfully combating each evil.

Malaya is especially fortunate in a climate which is unsurpassed for rapid growth of vegetation; but these exceptionally good conditions are also in some cases favorable to the prosperity of insect and fungal pests, and it is imperative that careful watch should be kept by all the cultivators so that the earliest signs of disease, to whatever cause due, may

[1] From the report of the Director of Agriculture, Federated Malay States, in Agricultural Bulletin of the Straits and Federated Malay States, Vol. VII, No. 11, November, 1908.

be brought to the notice of the department. Delays in the treatment of any disease are dangerous, and every year cases are reported in which, if preventive and curative measures had been taken earlier, a good deal of labor and expense would have been saved. All effective measures for the preservation of health, whether carried out by individuals or by the government, rest upon exact knowledge of the causes of the diseases and the effects they produce. The best time to investigate a disease of cultivated crops is the first time it is observed and not when it is found that great damage is being done.

The plots of camphor show that this plant will grow in Malaya at sea level with great vigor. My experience of this plant in Ceylon was entirely different, there the most vigorous plants were some thousands of feet above sea level, but the growth of the trees in Batu Tiga and Kuala Lumpor plots has been so extraordinarily rapid that there is no doubt of the suitability of this climate to the cultivation of this plant.

Agricultural acreages in the Federated Malay States, 1907, excluding padi and horticulture.

Acreage in—	Selangor.	Perak.	Negri Sembilan.	Pahang.	Total.
Coconuts	21,321	57,776	18,000	15,463	112,560
Rubber	61,552	46,167	17,656	860	126,235
Coffee	7,595	756	2,382	100	10,833
Other cultivations chiefly tapioca	1,604	10,270	261		12,135
Total	92,072	114,969	38,299	16,423	261,763

COCONUTS.

Inspectors of Coconuts.—Coconuts have had a prosperous year without any serious outbreak of disease, and the diseases which are already rife have been during the year successfully combated by the inspector of coconuts and his staff. It is not easy to estimate what damage would have been done to the coconut industry if the coconut preservation staff had not been in existence, and it is not, therefore, possible to give any idea as to the amount, no doubt very considerable, which this preventive and curative work has added to the wealth of the country.

Mr. T. C. Nock, assistant inspector of coconuts, took up his duties early in the year and has already proved the value of his appointment by the energy and interest he has displayed in his work. An increase over last year of about 7 per cent in the acreage of this staple industry shows that there is an appreciation of the profits which can be gained by the cultivation of coconuts.

This important branch of the agriculture of the Federated Malay States, covering at the end of last year 112,500 acres, is dealt with in detail in the report of the inspector of coconuts. During the past year,

owing to the drop in rubber prices, there has been a tendency to take an interest in the "Consols of the East" cultivation, and land has been taken up which will be planted with this easily cultivated and profitable palm.

RICE OR PADI.

The problems of rice culture have been of special interest. Long years of cultivation in many countries have evolved methods which must to a great extent command attention and carry weight because of the fact that they are the outcome of a process of selection of the fittest method. Though this fact should not deter from the desire to find how they can be still further improved, it gives to the problems in *padi* cultivation a different aspect from those with which we are faced in a new cultivation like rubber, with very little past history, and no experience wrapped up in tradition capable of being extracted and made useful.

The experiments carried on at Parit Buntar owe much of their success to the care of Mr. F. F. Faithfull, A. M. I. C. E., assistant engineer Krian Irrigation Works, who took the greatest interest in all the problems which it was hoped to solve and recorded with great care all the necessary data. He aroused the interest of the *padi*-planting Malayas in the neighborhood of the experimental plots and explained to them the purpose of the different experiments and the value of the results.

Irrigation.—The Federated Malay States government has spent a large sum of money in increasing the fertility of some 70,000 acres of excellent *padi* land by a comprehensive irrigation scheme, and it is important that all within that area, should enjoy not only the advantages of the regular water supply, but that their methods of cultivation should be such that these advantages can be reaped as bountifully as possible.

I have not been able to get accurate statistics as to the relative yields per acre outside and inside the artificially irrigated area, but all the observations I have made and all the data I could obtain point to the fact that the crop has been increased probably 30 to 40 per cent by the use of irrigation. The monetary value of this is easy to calculate.

Enemies of Padi.—The crops of *padi* all over the Federated Malay States were about average, except inside the irrigated area where they were greater than usual, and some areas near Kuala Kangsar which were badly attacked and damaged by rats. Mr. Gallagher kindly undertook an investigation as to methods of combating this ubiquitous pest, and his preliminary experiments with carbon bisulphide were most encouraging. They will be continued when the next *padi* crop is planted, and it is probable that this method may prove an effective and practical way of ridding the *padi* planter of one of his constant and expensive enemies.

With regard to other enemies of *padi,* eelworms and fungi—more insiduous because less easily detected, but none the less detrimental-

these pests are automatically lessened within the irrigation area by the regular application of water and uniform times of letting off the water and drying the plants above ground. Where the plants are left too long in their young and tender condition without water they are open to the attacks of certain insect pests, and when they are kept too long growing in water other pests are enabled to thrive. In addition to this the value of the power of at any time drying or flooding the *padi* fields is in itself an admirable weapon against diseases.

Padi Experiments.—The following table shows the results of last year's experiments, the chief object of which was to determine the question as to how many plants per "perdu"—i. e., group of young plants put in one hill—and how many hills or "perdu" per acre give the largest yield. The seed crop was weighed and measured and the straw was weighed. It is too soon to draw definite conclusions until these experiments have been continued and expanded for some little time.

Padi experiments, Krian, 1907.

Letter of plot.	Variety planted.	Date of planting in nursery.	Date of transplanting in nursery.	Date of final planting in field.	Average number of plants per "perdu."	Distance between "perdu"		Number of "perdu" per acre.	Number of plants per acre.	Date of reaping.	Amount of crop per acre in gantong=1 gallon.	Weight of crop per acre (pounds).	Weight of straw per acre (pounds).	Number of grains of seed in 1 gram.	Number of seed per head.
		1907.	1907.	1907.		*Ft.*	*in.*			1908.					
C	Saraup	July 13	July 24	Sept. 12	3¼	1	0	43,560	152,460	Feb. 1	614	3,420	17,736	52.40	249
B	Radin	---do	---do	Sept. 4	3⅛	1	6	19,360	67,760	Jan. 17	542	2.966	13,424	44.74	200
E	---do	---do	---do	Sept. 6	3⅛	1	0	43,560	152,460	Jan. 19	492	2,714	15,746	49.91	206
D	---do	---do	---do	Sept. 16	3⅛		9	77,440	274,040	---do	504	2,786	11,244	46.62	211
A	---do	---do	---do	Sept. 3	3⅛		6	174,240	609,840	Jan. 15	480	2,678	23,820	41.13	130
F	---do	---do	---do	Sept. 9	1		6	148,464	148,464	Jan. 19	516	2,834	15,838	47.50	190
G	---do	---do	---do	Sept. 5	2		9	77,440	154,880	Jan. 21	442	2,422	17,784	44.87	191
H	---do	---do	---do	Sept. 6	5	1	2	32,003	160,015	---do	502	2,782	18,650	49.71	210

COFFEE.

The acreage under coffee has increased a little, there being 10,833 acres last year as compared with 9,708 at the end of 1906. A large acreage of coffee is continually being killed out by the rubber trees, with which it has been interplanted, growing up and shading the coffee bushes so that they do not grow vigorously and only struggle in producing less and less fruit. Selangor possesses 75 per cent of the whole acreage. The crops have been on the whole good, but the figure of acreage crop is not of any value as a great deal of coffee growing under rubber and yielding little or no fruit is included.

TAPIOCA.

The cultivation of tapioca (*Manihot utilissima*), which occupies about 10,000 acres in the Federated Malay States, and more than double that area in the Straits Settlements, continues to give large returns to the careful planter. The tapioca plant is especially free from disease of leaf, stem or root, and its temporary cultivation makes it possible, should any pest attack it to destroy the affected plants and thus prevent the spread of the disease. During last year experiments were carried out to show the relative effect of different manures on tapioca, the results of which will appear in a future report. An investigation is being carried on in the scientific laboratories at Buitenzorg into the varieties of tapioca used in cultivation, and at the request of Dr. Treub specimens were sent from Malaya to be examined and experimented with.

RUBBER IN MALAYA.

The rapid progress of the rubber industry in Malaya continued during 1907, and at the end of that year 45,764 more acres of rubber land had been planted, an increase of about 46 per cent on the total of the previous year. The number of acres of planted rubber on the 31st of December, 1907, being 179,227. The number of trees in 1906 was under 13,000,000, and in 1907 27,558,400, a large acreage being planted closer than before.

The output of dry rubber increased by 144 per cent; 1907 showing an export of 2,278,870 pounds, or 1,017 tons, as against 936,056 pounds, or 417 tons, in the previous year. More than seven times the amount of rubber was exported in 1907 than two years before in 1905.

Rubber statistics in Malaya up to the 31st of December, 1907.

Item.	Federated Malay States.	Straits Settlements and Kedah.	Johore.	Total.
Number of estates	287	65	13	365
Acreage in possession	412,210	116,549	96,849	625,608
Acreage planted up to 31st of December, 1907	126,235	42,866	10,126	179,227
Acreage planted during 1907	40,473	9,344	5,764	55,581
Number of trees planted up to 31st of December, 1907	19,628,957	6,787,216	1,142,196	27,558,369

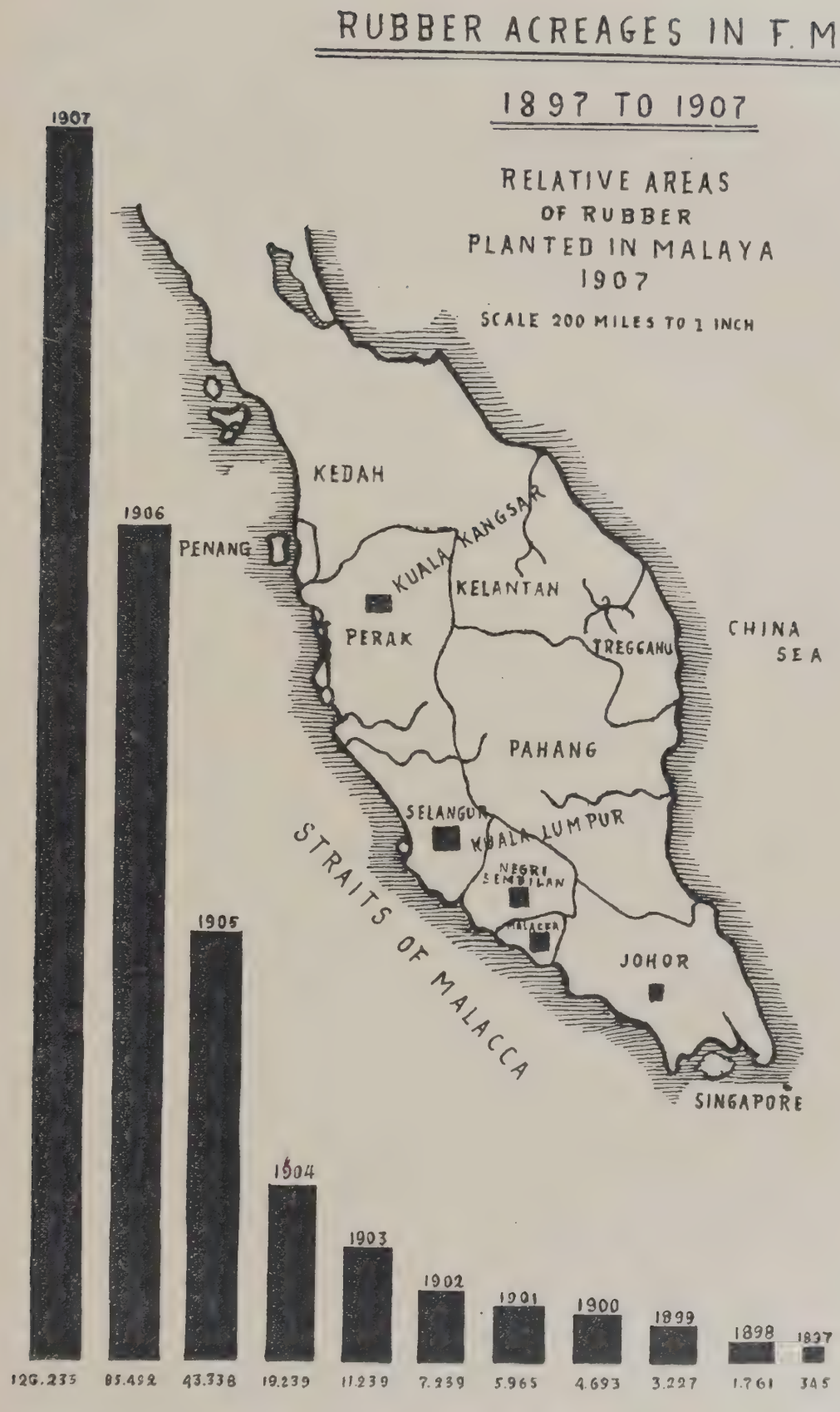

PLATE II. MAP AND CHART SHOWING TEN YEARS' GROWTH OF THE RUBBER-PLANTING INDUSTRY IN THE FEDERATED MALAY STATES.

RUBBER IN THE FEDERATED MALAY STATES.

At the end of 1906 there were in the Federated Malay States 85,000 acres, at the end of last year 124,580, an increase of about 46 per cent. There were 10,745,000 trees planted in 1906, and nearly 20,000,000 in 1907. The output of dry rubber was nearly doubled, showing 1,028,792 pounds, or 459 tons, in 1906, and 1,984,285 pounds, or 885 tons, in 1907, an increase of 93 per cent. Since January, 1906, the amount of rubber planted has been trebled, and the whole of that large acreage is in a healthy and vigorous condition.

Comparative table of rubber acreage and trees in Malaya, 1906 and 1907.

District.	Rubber acreage.		Number of trees.	
	1906.	1907.	1906.	1907.
Federated Malay States:				
Selangor	44,821	61,552	5,477,390	9,648,093
Perak	29,612	46,167	3,990,462	6,648,957
Negri Sembilan	10,663	17,656	1,196,150	3,165,388
Pahang	483	860	81,000	166,590
Straits Settlements:				
Malacca	[a]28,784	36,946	[a]472,056	6,019,946
Province Wellesley	4,738	5,920	615,940	767,276
Johore	4,362	10,126	[a]492,906	1,142,196
Total	123,463	179.227	12,325,904	27,558,446

[a] These figures are approximate.

In Province Wellesley is included one estate in Singapore, one estate in Penang and one in Kedah.

TEN YEARS OF RUBBER PLANTING IN THE FEDERATED MALAY STATES.

The history of rubber planting in the Federated Malay States is probably unique in the rapidity with which a new cultivation, found to be specially suited to the climate, has been established. The black columns on the chart show only the Federated Malay States acreages and do not include Malacca, Johore, and Province Wellesley. The progress of these places has, however, been approximately the same.

In 1897, rubber estates were less than 350 acres in extent, ten years after they had increased 360 times. In 1902 less than 7,500 acres had been planted; five years after 17 times that amount was under rubber. Nearly all of this land was virgin jungle previous to its being planted with rubber and had to be cleared before any planting operations could be begun. Nine-tenths of the whole acreage has been cleared and planted by the younger generation of planters, who deserve the greatest credit for the excellent way in which their work has been carried out. The difficulties under which most of them have opened up their estates have been many and varied: bad conditions of health, both for master and coolie, and steadily rising prices for labor owing to local conditions.

YIELDS OF DRY RUBBER PER TREE.

The average amount of dry rubber is, over the whole peninsula, 1 pound 12 ounces per tapped tree, exactly the same figure as was recorded for last year. This is most encouraging, as the number of trees which are being tapped for the first time far exceeds those already tapped, especially in Selangor, where the average is 1 pound 7 ounces per tapped tree.

Experiments are being carried on in various parts of the Peninsula—Perak, Selangor and Negri Sembilan—in regard to yields of comparatively old trees which have not previously been tapped. In Krian these experiments have been carried out for nearly four months, only half the tappable area of the trees being used and space being left so that more than three years will elapse, with continuous tapping every other day, before the healed surface will be reached again. The figures for one year will be published in next year's report, but as far as they have gone the yields average more than 2 pounds per tree a month.[1] The trees are planted widely apart round the edges of a graveyard and are about 17 years old.

There is as yet not sufficient evidence as to what yields may fairly be expected over large areas of trees from 10 to 20 years old, but all the data which we have at present points to the fact that estimates or prophecies of probable yields at these ages will be amply confirmed.

Comparative table of rubber crops in Malaya, 1906 and 1907.

District.	Number of trees tapped.		Rubber yields (pounds).		Average yield per tree, 1907.	
	1906.	1907.	1906.	1907.		
					Lb.	*Oz.*
Federated Malay States:						
Selangor	364,638	772,656	620,033	1,131,086	1	7⅛
Perak	67,710	132,556	94,848	272,804	2	1
Negri Sembilan	91,410	240,401	146,891	586,864	2	7
Pahang						
Straits Settlements:						
Malacca	[a]7,000	12,455	[a]12,000	23,490	1	14
Province Wellesley	20,076	48,000	[a]13,560	82,131	1	11
Johore	48,350	94,159	47,724	182,495	1	15
Total	599,184	1,300,227	935,056	2,278,870	1	12

[a] These figures are approximate.

In Province Wellesley is included one estate in Singapore, one estate in Penang and one in Kedah.

OVERPRODUCTION AND SYNTHETIC RUBBER.

The fear of overproduction which appeared very large a year or more ago has, owing to more accurate knowledge of the world's demand for rubber and the amount produced, to some extent subsided. The drop in prices, while having the effect of reducing the amount of rubber

[1] This is probably an error and the author means 2 lbs. a year. (Editor.)

planting, may also to a great extent reduce the output from Brazil, where the margin of profit is much less than in cultivated rubber.

This also should lead not only to a consideration of cheapening of methods of production, but to the possibilities of increasing the demand for rubber. No product lends itself more to measures for improving and widening the market. The almost endless possibilities for the economic use of rubber, and the small proportion of the purchasing population of the world which at present knows and uses rubber, both demonstrate the fact that measures taken to provide new outlets for rubber are much more hopeful than in the case of food or textile products like coffee or copra, which have a comparatively limited number of uses.

It is not to the interest of cultivated rubber that the output of the Brazilian product should decrease very rapidly. There is not yet sufficient cultivated rubber or wild rubber from other sources to supply the increasing demand. Those who look forward to a future for immense areas of cultivated rubber in suitable climates, of which the Malay Peninsula can claim to be the best, believe that cultivated rubber will in time satisfy all the manufacturers in regard to its physical qualities and will be produced in sufficient quantity to meet the world's requirements. It is not easy to foresee the future demands for rubber, but a substance which has made itself so indispensable to all civilized races must be required in increasing quantities, and the fear of overproduction may be canceled, by the quite as likely possibility of the supply not meeting the demand and the consequent resort to other substances as substitutes for rubber.

IS CLEAN WEEDING ADVISABLE.

Weeding on most of the rubber estates in the Federated Malay States is the item costing most annually. This sum is spent on labor, and represents in many cases 70 per cent or more of the total labor of the estate.

The object of the rubber planter is to obtain as quickly as he can vigorous trees of as large a girth as possible, at the smallest cost, and in order to effect this he keeps his fields as clear of weeds as possible and so allows the rubber tree to have all the moisture and plant food available in the soil.

That clean weeding will show a better result in the growth of the rubber trees than allowing all and any weeds to grow continuously, can no doubt be proved. In Perak, however, some of the estates from want of money or shortness of labor have not been able to keep their plantations clear of weeds and have abandoned weeding. In some cases the weeds are checked by being regularly cut, but in others nothing at all has been done to eradicate or discourage the weeds.

The growth of trees on such places is somewhat poorer than trees in

similar condition which have been kept free from weeds, but the vigor and girth of the trees where the weeds have been allowed to grow is not so markedly different as the disciples of clean weeding would expect to see.

The belief in clean weeding is a tradition handed down from English farming to tea and coffee planting in the East; good farming is associated with absence of weeds. In Europe, the farmer of cereals and other crops does not practice the method of using certain plants as a substitute for weeds. There are various reasons why clean weeding in such crops is a good policy in Europe, but annual crops have to be treated differently from permanent cultivations, and the conditions of labor, cultivation, plant growth and especially climate are entirely different in the tropics from those in temperate climates and consequently methods have to be modified.

The objections to clean weeding in rubber cultivation in the Federated Malay States and removal of all protection from the surface of the soil are that it allows a large amount of percolation of heat radiation and of evaporation of moisture, also that heavy rainfall on all but flat surfaces always results in the constant removal of very large quantities of top soil, which are either carried away in streams or transferred to the drains. It is not easy to estimate the loss that takes place in tropical climates where the soils are allowed to remain exposed and frequently scraped. An immense amount of plant food is continually lost through percolation and drainage; the greater part of this is absorbed by the roots of any plants growing on the surface; and when the leaves and stems of these plants are cut this is to a great extent returned to the soil.

With the soil protected from the rays of the sun the conditions of moisture and temperature are most favorable to the development of bacteria which are responsible for the liberation of plant food. In clean weeded land the top 2 inches or more of soil are, because of admission of heat and light, made impossible for feeding roots and the preparation of food for them. When the ground is covered this surface layer is kept moist and useful for the feeding roots. A considerable area is thus added to the area of soil available for rubber roots and the growth of the trees is improved.

In addition to arguments for clean weeding there is a local one, the danger of the ground being taken possession of by "lalang" (*Imperata arundinacea*), a pestilent weed, which once allowed to invade a plantation can only be eradicated at enormous expense. This plant is ubiquitous, is always one of the first to cover newly opened land, and by far the most difficult weed to eradicate.

The experience gained in the use of tapioca as a catch crop in rubber, which obtains on some thousands of acres of rubber showing excellent growth, is another argument in favor of keeping the soil covered up. Few, if any, crops take more from the soil than tapioca, but this loss

of valuable plant food in the soil is to a great extent compensated for by the advantage of keeping the soil from the sun and rain. The girths of young rubber trees grown with tapioca are in many cases as large as those of trees in similar land, clean weeded, and without any other crops.

Though figures of cost of weeding vary very greatly, on some estates the cost two years after the land has been opened is not under $2 per acre, per month, or $24 a year. This represents on an estate of 1,000 acres a cost of $24,000 per year, and a probable cost for weeding of nearly $100,000 before the rubber is in bearing. In labor it represents a continual force of about 250 coolies working for three hundred days in the year.

I have for the last three years been investigating the question of a substitute for weeds which will reduce the wage bill without reducing the rapidity with which the rubber trees grow, and mentioned in my annual report for last year three plants which observation and experiment show to be suitable and therefore worth a serious trial on every estate. These three plants belong to the order Leguminosae, the clover, pea and crotaloria tribe, a group of plants many of which are characterized by the possession of bacteria on their roots. These bacteria, the life history of which has been investigated fully by a large number of botanists and agriculturists, live in what is technically called symbiotic relationship; i.e., both host plant and bacterium being of mutual service to each other. In a report of this character it is unnecessary to more fully explain this point, but it will suffice to say that the bacteria which form characteristic nodules on the roots of the host plant, take nitrogen from the air, and this nitrogen is afterwards available in the soil as plant food. The amount of nitrogen thus added to the soil varies with the species of the bacteria and their numbers, but in the case of one of the plants hereafter mentioned experiments have shown it to be as much as 200 pounds per acre a year.

The three plants which seem to me most suitable in Malaya for the purpose above mentioned are: I, *Crotalaria striata;* II, *Mimosa pudica;* III, *Desmodium triflorum.*

I. *Crotalaria striata* is a quick-growing vetch-like plant with trifoliate darkish green leaves. In good soil with sufficient rainfall it grows to a height of 6 feet in about a year. When sown sufficiently thick it completely covers the ground within a few weeks, so that the clearing is like a good lucerne or vetch crop in Europe, and the surface of the ground is not seen at all.

It has been proved by experiments with this plant in Ceylon that 14,000 pounds of organic matter were formed by crotalaria under cacao, and the nitrogen in this organic matter was equal to that in 1,700 pounds of castor cake or 700 pounds of nitrate of soda. Other plants—weeds—can not get enough light under the dense cover of the crotolaria, and

new weeds are kept out as their seeds can not reach the ground which is so well covered. If the crotalaria is sown in good growing weather, and if the land is clear of all weeds, no further weeding should be necessary, but in the case of land which is thoroughly permeated with the underground stems of lalang or with the roots of other weeds it may be found that during the first two or three months weeding is necessary. The crotalaria seed is sown broadcast. As to the quantity to be used per acre it is better to sow more than is necessary than to leave bare patches where weeds can thrive. Mr. Lauder Watson, who is the first Federated Malay States planter to use this plant in rubber planting, informs me that at Lauderdale he used about 7 pounds. I have seen good results from using only 4 pounds per acre.

II. *Mimosa pudica,* the "sensitive plant," which was another of the plants suggested in the last annual report, is in many ways the best of all plants to put down as a substitute for weeding. In many cases it has taken less trouble to establish this plant than crotalaria, and it thrives extremely well in the Malayan Peninsula on varying soils. The peculiar habit of shutting up its leaves when touched is in its favor. When rain falls at all heavily the leaves shut and the water reaches the soil at once, but when the sun shines again the leaves open up and protect the soil from the sun's rays. My experience of this plant is that while it grows well on sloping and dry land it seems to enjoy more moist conditions and can be seen in great vigor in ravines and flat places where the moisture is more abundant.

III. *Desmodium triflorum,* a small creeping shamrock-like clover, has the advantage that it grows only a few inches high and covers the ground with a turf easy and pleasant to walk on. It is, however, more difficult to establish, and as it seeds very sparingly, it is not easy to obtain any quantity of seed for planting. On one estate some 200 acres have been successfully laid down with this plant by taking it from neighboring waste land and planting it as soon as the land was cleared.

The question of the best method of establishing one or other of the substitutes for weeds or clean weeding is being experimented on both at the experiment plantations of this department and by various planters who are alive to the great advantages to be gained if they can cover their ground with a friendly plant. By far the best time to establish one of these plants at a minimum cost is directly after the land has been burned off. In virgin land after burning no seeds of herbacious plants are alive in the soil, and any seeds sown of plants planted have no competitors and quickly take possession of the soil. Having once got the plant established at the danger of lalang or other weeds gaining an entrance, the immediate necessity of putting the rubber in is over, since the fields do not get any worse, but rather better for the reception of the rubber plants and the cost of cutting away the crotalaria, mimosa or other plant to put in lines and holes is very little. Drains are not

necessary or even useful and thus another expense is saved. The only weeding necessary is in case jungle trees or shurbs sprout, and these can easily be noticed among the prevalent growth of a single plant and removed. No soil is lost from the begining of the opening of the land, and the gain in this to the roots of the rubber plant is not to be neglected.

RUBBER MACHINES.

The number of estates which have trees of sufficient growth for tapping is as yet not very many, but each year more become productive, and the question of the best and most economical machinery for preparing rubber for the market and for cleaning "scrap," "bark," and "earth" rubber is one of the most important in the profitable working of an estate.

Dr. Kuhleman, chemical adviser to one of the largest rubber manufactories in Germany, paid a visit recently to this country to acquaint himself with the methods of the planter in his preparation of rubber. He was impressed by the care which is universally taken to ensure the purity and cleanliness of the rubber sent home.

In asking his advice upon the plant used by the planter, Dr. Kuhleman informed me that one point which he noted was, that the washers and rollers, in use on estates were very short in length. This was the case in the beginning of the manufactories in Germany. Machines with narrow rollers were at first put up and then when these could not deal with, the amount of rubber required more were added, but it was soon found more economical to have one roller of 10 feet long than five of 2 feet. It will be well that planters should in making arrangements for their rollers and washers look ahead to the time when they are producing much larger quantities of rubber than at present. The machines at present in use are, for dealing with a large quantity of rubber, mere toys and will either have to be multiplied or larger machines put in.

The longer rollers have an advantage over the short ones, at present in use, in that the risk of oil reaching the rubber from the bearings as it passes through the rollers is decreased. Rubber prepared in a number of small-length machines will be in more danger of being discolored at places than that prepared in fewer and longer rollers. The length of rollers in rubber-washing machines used in factories in Europe is often 12 feet, whereas, as a rule on estates in the Federated Malay States, two or more rollers of not more than a foot in length are often used.

PREPARATION OF RUBBER FOR THE MARKET.

Block rubber, the advantages of which for packing, transportation and preservation are undoubted, has not commended itself generally to the planter. Until large quantities of any of the forms of rubber produced in Malaya, viz, block, crêpe, and sheet, are put on the market, it will not be possible to settle the much-vexed question as to the advantages of each. The sale at a big price, of a shipment of any of these forms, at

once produces the impression that that special form is more attractive to buyers and will command better prices, but it should be remembered that the quality of the rubber as well as the shape in which it is sent is a factor, and the most important factor, in determining its market value. In whatever form it is sent it is of the most vital importance that planters should continue to aim at the purest and cleanest rubber. The manufacturers have begun to realize the advantages of the freedom from impurities which Eastern plantation rubber possesses, and this good opinion is too valuable to be endangered by using less care in preparation.

RUBBER SEED FOR OIL MANUFACTURING PURPOSES.

Rubber seed, both with the husk on and decorticated, has been sent to the Imperial Institute and to various commercial firms dealing in such products in Europe and Australia in order to introduce this article to them with a view to a future market.

The oil from the seed is a drying oil not unlike linseed oil in appearance and smell, and probably will prove as good as, it not better than, the latter oil in manufacture of paints and varnishes. Manufactures or dealers wishing to have samples of the seeds either decorticated or in the shell should communicate with this department. A profit per acre after paying all expenses of picking, husking, packing and shipping of at least $5 to $8 may be earned on estates with trees in full fruit bearing. While the demand for considerable quantities of seed for planting purposes continues, this method of disposing of seed is very much more profitable than the sale for oil, but with an immense number of trees producing fruit the supply for planting purposes will soon greatly exceed the demand and an additional market is needed. If the seeds are left on the ground they germinate freely and money must be spent in weeding out the young plants.

The questions in regard to the best methods of preparation and packing of the seed in exporting it for oil purposes continue to engage the attention of the department of agriculture, and a further report will be issued.

AGRICULTURAL NOTES.

GENERAL CONDITIONS.

The weather.—There was but little change in the prevailing weather conditions during the month of March and the drought which is general and a regular occurrence at this season of the year caused appreciable damage to crops of rice, corn and tobacco in some towns of Batangas, Bohol, Cagayan, Cebu, Ilocos Sur, Isabela, Lepanto Bontoc, Leyte, Occidental and Oriental Ngeros, and Samar. Reports from Bucay in Ilocos Sur, Moncada in Tarlac, San Nicolas in Ilocos Norte, Calolbon in Albay, Danao in Cebu, and Antequera in Bohol, state that there was a steady drought but at the time reported no serious damage had been done. According to reports from our correspondents in Oslob and Asturias in Cebu, the corn and tobacco crops were suffering most from the drought. The same report was received from the towns of Janiway in Iloilo, Manawag in Pangasinan, and San Luis in Pampanga.

From the above reports it would seem that agricultural crops generally do well at this season only in comparatively few sections where the lands are irrigated. On the other hand, in a few sections the land was in a good state of cultivation, crops were in a flourishing condition and if weather conditions continue favorable good harvests are sure to be gathered. Such reports were received from Sagnay in Ambos Camarines, Mariveles in Bataan, Santa in Ilocos Sur, Dapa in Surigao, Tayasan in Oriental Negros and several other places. In Tandag, Surigao, recent showers were taken advantage of for a second planting of rice. Excessive rains which were doing considerable damage to crops of rice and corn were reported from San Francisco de Malabon in Cavite, Catarman in Samar, Baybay and Macrohon in Leyte.

Rats and locusts.—Crops of palay and sugar cane in Bacon, Sorsogon, and Himamaylan in Occidental Negros are reported to have been damaged considerably by rats and locusts. In other places it is reported that rats have done considerable damage in the rice fields, though according to the reports sent to us the damage was much less than it was several months ago. During the last week in March small swarms of locusts were reported on some of the sugar cane plantations in the towns of Bacolod, Murcia and Cadiz in Occidental Negros; however, fortunately but little damage was done.

Farm help.—From several places throughout the provinces the lack

of farm help has been repeatedly reported as interfering with the necessary work of harvesting. Such a situation has been emphasized by our correspondent at Danao on the Island of Cebu, which condition is doubtless due to the employment of many laborers on the Philippine Railway. In Mindanao, and particularly in Davao, a considerable portion of the harvests has gone to waste because of a lack of farm laborers, and this situation must be met if farming is conducted on a large scale as seems to be the desire of the Mindanao planters.

Animal diseases.—In Himamaylan, Occidental Negros, rinderpest was reported as disappearing and foot-and-mouth disease as having been completely stamped out. Cattle disease was reported as having reappeared in Tanauan, Leyte, Binmaley in Pangasinan, and Ibaan in Batangas. In the first two municipalities the reappearance of the disease was owing to carelessness and the neglect of precautions which should have been taken in the case of all suspicious animal diseases. In these towns no isolation or quarantine of the animals was maintained to prevent the spread of the disease. Rinderpest was also reported from the municipalities of Tayum in Ilocos Sur, Caloocan in Rizal, Navas in Capiz, Cabatuan in Iloilo, and a few other towns. The veterinarians of this Bureau are inoculating cattle as fast as they can reach the infected sections and the results of their work are decidedly encouraging, as there seems to be a great decrease in the number of animals infected. It is hoped that this disease may be stamped out in the near future.

CROPS.

Abacá.—The decrease in the price of hemp is discouraging to planters and many of them are preparing their lands for planting other crops with the hope of regaining the losses incurred through growing abacá. From Cabadbaran in Agusan abacá planting is reported as being abandoned, half of last season's crop having been lost. According to our correspondent there, one kilo of abacá costs ten centavos while in Ambos Camarines the price of a picul varies between ₱5 and ₱6. From other sections where hemp has been the staple crop it is now reported as of secondary importance because of the prevailing low price and the small demand for even inferior grades, so that hemp planters are being compelled to turn their attention to crops which yield better returns.

Our correspondent from Pilar, Sorsogon, reports that "pacol," an inferior grade of hemp, is one of the most important local products and that 280 piculs of this fiber were marketed during the month of March at ₱4.50 per picul while the price of hemp in the same locality is ₱6.50 per picul.

Sugar.—The sugar crop is reported as being very satisfactory in sections where sugar cane is grown. Abundant crops are reported as harvested in La Carlota, Occidental Negros, Nasugbu in Batangas, Morong in Rizal, and Santa Cruz in Laguna. The milling of sugar cane

has been intermittent in some sections on account of scarcity of labor. In Danao, Cebu, it is stated that so much land has been planted to sugar cane that it is thought to have considerably lessened the amount planted to corn.

While the grinding of sugar cane continues, in many places the fields are being prepared for a new crop. Fair harvests of this product are reported from Balayan, Batangas. In most places all of the sugar cane has been harvested although in some places there are a few fields which have not yet been gathered.

Our correspondent from San Nicolas, Ilocos Norte, reports that during February and March 10,300 tinajas of *basi* and 3,900 piculs of molasses were sold at ₱2 a tinaja for *basi* and ₱3 a picul for molasses.

Rice.—A good crop of rice is reported as harvested in Candaba, Pampanga, Santa Rosa and Siniloan in Laguna, Quiangan in Nueva Vizcaya, and Gapan in Nueva Ecija. Fair sized copras were also harvested in San Rafael, Bulacan, Tanawan in Leyte, Biñan in Laguna, and Antequera in Bohol. In the towns of Batangas, Bohol, Cagayan, Capiz, Cebu, Ilocos Sur, Isabela, Lepanto-Bontoc, Leyte, Occidental and Oriental Negros and Samar the rice crop was reported as considerably damaged by the drought.

Coconuts.—The coconut crop is reported from many municipalities as being in a flourishing condition. The coconut trees in Siniloan, Laguna, Janiway in Iloilo, Calolbon in Albay and Mariveles in Bataan were reported as promising an excellent harvest.

Corn and tobacco.—The corn and tobacco crop as previously stated seems to have suffered most from the present drouth. A good quantity of corn is reported as harvested in Magsingal, Ilocos Sur, Bodian in Cebu and in several other municipalities. A large crop of corn was harvested in the municipality of Antequera in Bohol. During the month of March preparation was being made for the first planting of corn and the second planting of *palay*.

Our correspondent from Libmanan, Ambos Camarines, states that "ikmó" leaves (*Piper betle*) command a good price, that they are more extensively cultivated there than in any other part of that section of the country, and that this one town supplies all of the towns in the Provinces of Albay and Ambos Camarines.

The correspondent from Bacon, Sorsogon, informs us that 18,000 pounds of ylang-ylang which was selling for five centavos per pound had been collected.

CROPS PLANTED AND HARVESTED AND CONDITION OF SAME TAKEN FROM MONTHLY CROP REPORTS FOR THE MONTH OF FEBRUARY, 1909.

[RICE.—This article is in the unhulled state.]

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Area.	Quantity.	Unit.
Agusan (reports from 3 towns):		*Hectares.*	*Hectares.*		
Rice	Good	120			
Abaca	do	8	15	689	Piculs.
Coconuts	do			30,000	Nuts.
Corn	do			70	Cavans.
Albay (reports from 12 towns):					
Rice	do	37	615	7,110	Do.
Abaca	do	79	1,907	7,265	Piculs.
Coconuts	do			639,800	Nuts.
Corn	do	72	20	90	Cavans.
Ambos Camarines (reports from 27 towns):					
Rice	do	67	1,757	28,794	Do.
Abaca	do	273	6,220	26,977	Piculs.
Coconuts	do			977,000	Nuts.
Sugar cane	do	15	10	12	Piculs.
Antique (reports from 8 towns):					
Sugar cane	do	382	251	4,015	Do.
Coconuts	do			7,000	Nuts.
Abaca	do		4	47	Piculs.
Corn	do	114	2	8	Cavans.
Bataan (reports from 6 towns):					
Rice	Fair	28	735	6,862	Do.
Sugar cane	do	193	130	6,650	Piculs.
Corn	do	2		21	Cavans.
Coconuts	do				
Batangas (reports from 12 towns):					
Rice	Good		20	240	Do.
Sugar cane	do	1,270	1,468	33,884	Piculs.
Corn	Fair	70	618	2,430	Cavans.
Abaca	do		17	34	Piculs.
Benguet (reports from 8 towns):					
Rice	do	41			
Sugar cane	do				
Coffee	do				
Bohol (reports from 24 towns):					
Rice	do	330	75	1,000	Cavans.
Abaca	Good	19	104	417	Piculs.
Coconuts	do			1,923,000	Nuts.
Corn	Fair	1,360	202	3,879	Cavans.
Bulacan (reports from 13 towns):					
Sugar cane	Good	723	2,160	2,215	Piculs.
Corn	do	10	2		
Rice	do	10	10,332	221,970	Cavans.
Tobacco	Fair	3			
Cagayan (reports from 11 towns):					
Tobacco	do	1,023			
Corn	Good	763			
Coconuts	do			8,000	Nuts.
Rice	do		950	6,530	Cavans.
Capiz (reports from 15 towns):					
Sugar cane	do	37	26	962	Piculs.
Coconuts	do			123,000	Nuts.
Corn	do	47			
Abaca	do	49	117	498	Piculs.

Crops planted and harvested and condition of same taken from monthly crop reports for the month of February, 1909—Continued.

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Area.	Quantity.	Unit.
		Hectares.	*Hectares.*		
Cavite (reports from 6 towns):					
Sugar cane	Good	366	447	10,515	Piculs.
Corn	do	5	35	615	Cavans.
Rice	do		2,300	38,000	Do.
Coconuts	Fair			45,000	Nuts.
Cebu (reports from 30 towns):					
Coconuts	Good			716,000	Do.
Corn	Fair	2,111	19,565	233,957	Cavans.
Rice	Good	175	399	3,975	Do.
Ilocos Norte (reports from 10 towns):					
Rice	Fair		6,171	92,590	Do.
Sugar cane	Good	239	632	610	Piculs.
Tobacco	do	231	243	2,160	Quintals.
Maguey	do	40	10	100	Piculs.
Ilocos Sur (reports from 19 towns):					
Sugar cane	do	626	482	7,090	Do.
Tobacco	do	78	30	151	Quintals.
Corn	do	1,169	125	728	Cavans.
Maguey	Fair	6	296	2,722	Piculs.
Iloilo (reports from 15 towns):					
Sugar cane	Good	446	528	132,070	Do.
Coconuts	do			31,000	Nuts.
Rice	do		4,200	43,000	Cavans.
Corn	do	527	45	100	Do.
Isabela (reports from 4 towns):					
Tobacco	Fair	346	29	252	Quintals.
Corn	do	95			
Rice	do				
La Laguna (reports from 20 towns):					
Coconuts	do			2,258,000	Nuts.
Abaca	Good	6	680	728	Piculs.
Sugar cane	Fair	3	260	12,050	Do.
Rice	do	1,167	2,241	57,850	Cavans.
La Union (reports from 11 towns):					
Tobacco	Good	1,163	61	469	Quintals.
Corn	do	14	6	24	Cavans.
Sugar cane	Fair	74	135	2,930	Piculs.
Coconuts	Good			79,000	Nuts.
Lepanto-Bontoc (reports from 15 towns):					
Tobacco	Fair	23	4	59	Quintals.
Sugar cane	Good	16	41	340	Piculs.
Rice	Fair	513	101	337	Cavans.
Corn	Good	160	62	273	Do.
Leyte (reports from 18 towns):					
Abaca	Fair	184	5,078	13,634	Piculs.
Coconuts	Good			1,248,000	Nuts.
Corn	do	517	391	6,080	Cavans.
Rice	do	449	332	8,820	Do.
Misamis (reports from 4 towns):					
Abaca	Fair	24	135	985	Piculs.
Coconuts	do			439,000	Nuts.
Sugar cane	Good		4	160	Piculs.
Corn	Fair		20	150	Cavans.
Moro Province (reports from 9 towns):					
Coconuts	Good			91,000	Nuts.
Corn	do		3	142	Cavans.
Abaca	do	12	164	1,306	Piculs.
Rice	do	95			
Nueva Ecija (reports from 16 towns):					
Rice			7,785	187,125	Cavans.
Sugar cane	do	118	15	650	Piculs.
Tobacco	Fair	51	35	150	Quintals.
Corn	do	15	7	16	Cavans.
Nueva Vizcaya (reports from 4 towns):					
Rice	Good				
Tobacco	Poor				
Sugar cane	Good				
Occidental Negros (reports from 14 towns:)					
Sugar cane	do	4,489	23,987	165,310	Piculs.
Coconuts	do			198,000	Nuts.
Abaca	Fair	55	35	139	Piculs.
Corn	do	323	200	2,000	Cavans.

Crops planted and harvested and condition of same taken from monthly crop reports for the month of February, 1909—Continued.

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Area.	Quantity.	Unit.
Oriental Negros (reports from 15 towns):		*Hectares.*	*Hectares.*		
Abaca	Good		192	1,799	Piculs.
Coconuts	do			1,192,000	Nuts.
Corn	Fair	72	165	4,690	Cavans.
Sugar cane	do	105	105	3,855	Piculs.
Palawan (reports from 2 towns):					
Coconuts	Good			1,031,000	Nuts.
Maguey	do				
Cacao	Excellent				
Pampanga (reports from 7 towns):					
Rice	Good	13,000			
Sugar cane	do	3,340	2,470	12,510	Piculs.
Corn	do	60			
Pangasinan (reports from 33 towns):					
Sugar cane	Fair	1,579	1,267	8,065	Do.
Coconuts	do			339,000	Nuts.
Corn	Good	466	428	2,145	Cavans.
Tobacco	do	506	361	1,501	Quintals.
Rizal (reports from 14 towns):					
Sugar cane	do	207	116	576	Piculs.
Abaca	do				
Rice	do		39	3,011	Cavans.
Corn	Fair	54			
Samar (reports from 21 towns):					
Rice	do	510	513	1,070	Do.
Abaca	do	92	1,032	5,368	Piculs.
Coconuts	do			263,000	Nuts.
Corn	Good	48	15	150	Cavans.
Sorsogon (reports from 18 towns):					
Rice	do	1,532			
Abaca	do	509	7,283	16,156	Piculs.
Coconuts	do			143,000	Nuts.
Corn	Fair	37	46	405	Cavans.
Surigao (reports from 6 towns):					
Rice	Good	800			
Abaca	Excellent	3	189	1,868	Piculs.
Coconuts	Good			20,000	Nuts.
Sugar cane	do	3	4	8	Piculs.
Tarlac (reports from 8 towns):					
Sugar cane	Fair	677	3,087	5,800	Do.
Tobacco	do	46	107	335	Quintals.
Rice	Good	400	5	17,100	Cavans.
Corn	do		10	100	Do.
Tayabas (reports from 15 towns):					
Rice	do	2,363	707	728	Do.
Coconuts	Fair			1,959,000	Nuts.
Abaca	Good	121	399	1,190	Piculs.
Corn	do	30	11	110	Cavans.
Zambales (reports from 8 towns):					
Sugar cane	Fair	62	49	370	Piculs.
Coconuts	Good			15,000	Nuts.
Corn	Fair	4			
Maguey	do		5	60	Piculs.

RANGE OF PRICES OF PHILIPPINE AGRICULTURAL PRODUCTS.

Highest and lowest prices of rice, abaca, copra, sugar, tobacco, and corn for the month of February, 1909.

Province.	Rice (unhulled) per cavan.		Abaca per picul.		Copra per picul.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
Agusan	₱3.50	₱2.00	₱7.00	₱4.00	₱7.00	₱7.00
Albay	3.75	2.00	9.00	4.00	6.50	4.75
Ambos Camarines	4.60	2.00	11.50	4.00	7.00	4.50
Antique	3.00	1.50	18.00	6.00	6.50	3.25
Bataan	2.50	2.00			4.00	4.00
Batangas	3.50	2.00	10.00	4.00		
Benguet	5.00	4.50				
Bohol	3.75	3.00	18.00	5.25	8.00	5.50
Bulacan	2.50	2.00				
Cagayan	3.75	2.25			5.50	5.50
Capiz	3.25	1.60	20.00	5.00	7.00	5.00
Cavite	2.60	2.40	17.00	17.00	7.00	7.00
Cebu	4.50	2.25	27.00	10.00	9.00	4.00
Ilocos Norte	5.50	3.00				
Ilocos Sur	5.00	2.50				
Iloilo	4.50	1.50	20.00	14.00	8.00	4.00
La Laguna	3.50	1.40	17.00	6.40	6.50	5.00
La Unión	4.50	3.00			8.00	3.00
Lepanto-Bontoc	5.00	3.00				
Leyte	4.00	2.50	13.50	4.50	10.00	4.00
Misamis	3.30	2.50	11.00	7.00	7.50	7.00
Moro	5.00	2.00	16.00	7.00	7.75	5.50
Nueva Ecija	3.50	1.25			4.00	4.00
Nueva Vizcaya	1.50	1.25				
Negros Occidental	3.00	2.50	15.00	11.00	8.60	5.00
Negros Oriental	5.00	2.50	14.00	6.00	8.50	6.00
Palawan	3.00	3.00			5.50	5.00
Pampanga	2.25	2.00	5.00	5.00		
Pangasinan	4.00	1.75			8.00	5.00
Rizal	2.75	2.25	18.00	18.00		
Samar	3.75	3.00	14.00	9.00	8.00	4.50
Sorsogon	3.75	2.50	14.50	4.50	7.00	5.00
Surigao	3.50	2.50	12.50	9.00	7.50	6.00
Tarlac	3.75	1.50				
Tayabas	5.00	3.00	15.00	4.50	6.50	4.25
Zambales	4.00	1.50			10.00	2.50

Highest and lowest prices of rice, abaca, copra, sugar, tobacco, and corn for the month of February, 1909—Continued.

Province.	Sugar per picul.		Tabacco, per quintal.		Corn per cavan.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
Agusan					₱2.25	₱2.00
Albay	₱6.00	₱6.00			1.50	1.50
Ambos Camarines	4.00	3.00			2.50	2.50
Antique	3.75	3.00			1.50	1.50
Bataan	6.00	5.00			2.00	1.50
Batangas	4.12	2.50	₱8.00	₱5.00	3.00	2.00
Benguet	6.00	3.00				
Bohol	5.00	4.00	25.00	25.00	5.00	2.50
Bulacan	7.00	5.75	20.00	12.00	3.00	1.50
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Cavite	4.20	3.50			3.00	2.25
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Ilocos Norte	8.00	1.50	18.00	4.00	3.00	2.50
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La Laguna	6.50	3.00			3.00	2.50
La Union	4.50	3.00	8.00	7.00	2.00	2.00
Lepanto-Bontoc	6.00	2.50	4.00	4.00	5.00	3.00
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Nueva Ecija	7.00	2.50	20.00	4.00	2.50	1.00
Nueva Vizcaya			5.00	5.00	1.50	1.50
Negros Occidental	4.90	3.43	8.50	3.50	2.80	2.50
Negros Oriental	5.00	4.00	30.00	4.00	5.00	2.50
Palawan			20.00	20.00		
Pampanga	5.50	4.00			2.60	2.60
Pangasinan	6.50	2.50	10.00	2.00	3.00	1.50
Rizal	4.50	3.50			5.00	2.25
Samar	5.00	5.00	35.00	20.00	2.50	2.50
Sorsogon	2.50	2.50	14.00	12.00	4.00	1.50
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Tarlac	5.25	2.00	8.00	4.00	5.00	1.25
Tayabas	4.25	3.00	6.00	6.00	5.00	3.00
Zambales	5.00	3.00	25.00	12.00	5.00	2.00

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Nueva Vizcaya, Pangasinan	J. J. Miller	Bayombong.
Pampanga, Tarlac	James Hill	Tarlac.

PERIODICALS RECEIVED IN THE LIBRARY OF THE BUREAU OF AGRICULTURE.

ENGLISH.

GENERAL.

Agricultural Bulletin of the Straits and Federated Malay States, Singapore.
Agricultural Gazette, Sydney, New South Wales.
The Journal of the Department of Agriculture of Victoria, Melbourne, Australia.
Journal of the Department of Agriculture of Western Australia, Perth.
The Queensland Agricultural Journal, Brisbane, Australia.
Tropical Agriculturist, Colombo, Ceylon.
Hawaiian Forester and Agriculturalist, Honolulu, Territory of Hawaii.
Memoirs of the Department of Agriculture, Calcutta, India.
Natal Agricultural Journal, Pietermaritzburg, Natal, South Africa.
Agricultural News, Bridgetown, Barbados.
West Indian Bulletin, Bridgetown, Barbados.
California Cultivador, Los Angeles, California.
The Rural California, Los Angeles, California.
Farmer and Fruit Grower, Jacksonville, Florida.
Louisiana Planter New Orleans, Louisiana.
Southern Cultivator, Atlanta, Georgia.
Progressive Farmer, Raleigh, North Carolina.
Farmer's Guide Huntington, Indiana.
Independent Farmer, Lincoln, Nebraska.
Kansas Farmer, Topeka, Kansas.
Farm Press, Chicago, Illinois.
The Feather, Washington, D. C.
The American Thresherman, Madison, Wisconsin.
Exporters and Importers Journal, Chicago, Illinois.
Oregon Agriculturist, Portland, Oregon.
Journal of Agriculture and Horticulture, Montreal, Canada.
Tropical Life, London, England.
Comercial America, Philadelphia, Pa.

REPORTS AND QUOTATIONS.

Crop Reporter, by the Secretary of Agriculture, Washington, D. C.
Federal Reporter, New York, N. Y.
Smith and Schipper's Monthly Report, New York, N. Y.
Hemp Market Report, Landauer & Company, London.
Ide and Christie's Monthly Circular, London.

LOCAL.

Official Gazette, Manila, P. I.
Philippine Journal of Science, Manila, P. I.
Far Eastern Review, Manila, P. I.
Weather Bureau Bulletins, Manila, P. I.
Philippine Agricultural Review.

SPANISH.

Boletin de la Cámara de Comercio Filipina, Manila, P. I.
Boletin Oficial de la Secretaría de Agricultura, Comercio y Trabajo, Havana, Cuba.
Boletin de Agricultura, San José, Costa Rica.
Hacendado Mexicano, El, Mexico, Mexico.
Agricultor Peruano, El, Lima, Peru.
Prácticas Modernas é Industrias Rurales, La Coruña, Spain.
Hacienda, La, Buffalo, New York.

OTHER LANGUAGES.

Bulletin de la Chambre de Commerce de Saigon, Saigon, Indo-China.
Boletim Economique, Hanoi-Haiphong, Indo-China.
L'Agronomie Tropicale, Brussels, Belgium.
Boletim de Agricultura, Sao Paolo, Brazil.
Tamil Journal of South India Agriculture, Madras, India.
Station Agronomique, Port Louis, Colony of Mauritius.
Journal D'Agriculture Tropicale, Paris.
Der Pflanzer, Kommunal-Druckerei, Tanga, Dutch, East Africa.

PLATE I.—PHILIPPINE ORANGE, "NARANJITA," GROVE IN BATANGAS PROVINCE.

THE PHILIPPINE

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EDITORIAL.

THE MAN WHO WORKS WITH HIS HANDS.

We are glad to present in this number of the REVIEW, following the article on the Country Life Commission in the May number, another article by ex-President Roosevelt on "The Man Who Works with His Hands," or the need of industrial training and education.

When one considers thoughtfully the industrial and economic situation in the Philippines and compares it with the conditions in the United States and other countries, it is seen that there is, after all, little difference in the attitude of mankind in general toward hard manual labor. In the United States, as is clearly pointed out by Mr. Roosevelt, there has been for years a decided tendency on the part of those born and raised

on the farms and in the country to seek the advantage of more thoroughly organized life as it is found in the cities. More than this, it is plainly pointed out that the tendency of education in the United States has been to train boys and girls away from the farm and to teach them to aspire to ideals of life and work which lead them away from the farm and from country life. Last year when addressing the superintendents of the National Educational Association, President Roosevelt charged the superintendents *not to deceive those whom they instructed by holding before their eyes unattainable ideals* and said, *"Statesmen, orators, writers, poets, and captains of industry are mere incidents when compared with the great wing of laborers in the world."*

In the Philippines we find very much the same fundamental attitude toward hard manual labor as in other countries; here it has been modified and accentuated by the tropical environment and the directing energies shaped by the popular ideals of the Spanish people and the Spanish Government for three hundred years. We are very little in sympathy with the fault found and the repeated charges made against the Filipino people for their lack of inclination to labor and carry on commercial enterprises like those carried on by the people in the temperate climates of Europe and America. There is little to induce the uneducated native of this country to put forth greater energy and to strive for greater organization and development of agricultural and commercial life, especially when he does not understand their advantages and when it is impossible for him, by reason of his environment, to realize their value to human society. When we consider fundamental conditions at home, we find that after all, in a great many cases, the underlying cause of the effort of the masses of so-called energetic Americans is absolute necessity, pride in position, and desire for the mighty dollar in order to meet the needs and the actual demands for one's life and the life of his family. We hardly see how the Filipino who does not understand or realize the advantages of well-organized and advanced agricultural, commercial and social conditions is to be expected to put forth energy comparable with that used by the American or European when his environment supplies almost every need of his daily life as he now lives. It seems to us as much a condition of cause and effect as anything could be—a problem in social and political economy. What we need to do is to stimulate, discipline and educate the people of this country, to let in the light so that they will understand and appreciate these higher social and commercial ideals, and, at the same time, hand in hand with this discipline and education, train their bodies for efficient service along the lines of those activities, occupations and trades which will be open to them with the development of the social, commercial and governmental life of their country, or, as Mr. Roosevelt states, to make of each person *an effective individual as an economic unit.* With the millions of pesos

invested annually for education in the Philippines we believe that the Government has a right and ought to demand such a product from its educational institutions for the money invested. Mr. Roosevelt states that *"our school system has hitherto been well-nigh wholly lacking on the side of industrial training, of the training which fits a man for the shop and the farm.* This is a most serious lack, for no one can look at the peoples of mankind as they stand at present without realizing that industrial training is one of the most potent factors in national development."

While the trades here are carried on almost entirely under the apprentice system, the most of them, from the highly developed standards of the same trades in America and Europe, are in such a crude stage of development as to make them of little value except as a working basis in the régime or condition of affairs which the people of the United States and the Insular Government of the Islands are endeavoring to bring about in promoting what seems to them the best interests of the people and the country and preparing them for that advanced stage and high plane of civilization in which they will be able to conduct the affairs of their own government.

Again, Mr. Roosevelt calls attention to the fact that *"We have tended to regard education as a matter of the head only and the result is that a great many of our people, themselves the sons of men who worked with their hands, seem to think that they rise in the world if they get into positions where they do no hard work whatever; where their hands grow soft, and their working clothes will be kept clean. Such a conception,"* he states, *"is both false and mischievous."* * * * "The calling of the skilled tiller of the soil, the calling of the skilled mechanic, should alike be recognized as professions just as emphatically as the callings of lawyer, of doctor, of banker, or merchant, or clerk. The printer, the electrical worker, the house painter, the foundry man, should be trained just as carefully as the stenographer or the drug clerk." *"To train boys and girls in merely literary accomplishments to the total exclusion of industrial, manual, and technical training tends to unfit them for industrial work; and in real life most work is industrial."* When Mr. Roosevelt states that "there should be libraries, assembly halls, social organizations of all kinds. The school building and the teacher in the school building should throughout the country districts be of the very highest type, able to fit the boys and girls not merely to live in but thoroughly to enjoy and to make the most of the country." That all kinds of agencies, from rural free delivery, good roads, the telephone and the telegraph should be favored and everything done to make it easier for the farmer to lead the most active and efficient intellectual, political, and economic life, he states the needs of the people in the Philippines as well as the people in the United States.

It is interesting to know that he believes that the Department of

Agriculture is, of all the Executive Departments in the Government of the United States, more directly and helpfully in contact with the daily life of the people, and that there is no other Department of the Government whose yield of practical benefits is greater in proportion to the public money expended.

Again he states what should be constantly borne in mind and what should be a guiding principle in the educational work of all the departments of government in these Islands when he says, "We shall never get the right idea of education until we definitely understand that a man may be well trained in book-learning and yet, in the proper sense of the word and for all practical purposes, be utterly uneducated; while a man of comparatively little book-learning may, nevertheless, in essentials have a good education." That *"exactly as the first duty of the normal man is the duty of being the home-maker, so the first duty of the normal woman is the duty of being the home-keeper; and exactly as no other learning is as important for the average man as the learning which will teach him how to make his livelihood, so no other learning is as important for the average woman as the learning which will make her a good housewife and mother."* In conclusion, Mr. Roosevelt states: "No outside training, no coöperation, no Government aid or direction can take the place of a strong and upright character; of goodness of heart combined with clearness of head and that strength and thoroughness of fiber necessary to wring success from a rough work-a-day world. Nothing outside of home can take the place of home. The school is an invaluable adjunct to the home, but it is a wretched substitute for it. No leader in church or state, in science, or art, or industry, however great his achievement, does work that compares in importance with that of the father and mother, 'who are the first of sovereigns and the most divine of priests.'"

ORANGE CULTIVATION IN BATANGAS PROVINCE.

In this number we are glad to present the first descriptive article on the subject of orange cultivation in the Philippines—"Orange Cultivation in Batangas Province," by Mr. Mariano M. Cruz, agricultural assistant in the Bureau of Agriculture. Probably one of the most interesting industries in the Philippines, and certainly one that has aroused the widest interest in different parts of the United States, from Florida to California, is the cultivation of oranges.

While very little has been done, as yet, in a scientific way to investigate the development of the orange industry in these Islands, at the same time it is clearly seen from the statements of Mr. Cruz that the industry is in its very earliest stages and that little or nothing has been done in a scientific way toward its development. The fundamental principles for all agricultural progress, such as the selection of seed, the careful and

systematic cultivation of soils, the use of fertilizers, intelligent pruning and the grafting of trees to secure modified or new varieties of the fruit are apparently unknown to the grower of oranges in the Philippine Islands. However, we believe that the facts presented by Mr. Cruz, covering the number of oranges produced, the principal sections where they are raised, the care given to the trees, the cost of care and cultivation, and the income from the product of these orange groves, as well as the statement concerning the more common enemies and diseases which have been noted, together with some very pertinent and valuable suggestions for improving this industry in Batangas and other provinces, will be of decided interest to our readers and may be the means of indicating to some the large possibilities which there are in the way of developing the orange industry in these Islands.

So far, no obstacle has been discovered, no sufficient reason has been revealed to indicate that the demand of the Insular orange market can not be met by developing the native industry. At present it is well known, as is stated by Mr. Cruz, that large quantities of oranges from China, Florida, California, and other parts of the world supply the Philippine demands for this product.

CULTIVATION OF THE PEANUT PLANT.

In this number of the REVIEW we are presenting a rather interesting article on the cultivation of the peanut plant, by Señor Ramón Garcia Oses, director of the Rio Verde agricultural experiment station in Mexico. The peanut plant is cultivated more or less on a small scale, it is believed, in nearly every part of the Philippine Islands to supply local demands. This industry is, apparently, in very much the same stage as that of raising cacao to supply the local markets. A considerable amount of peanuts is imported from China and a small amount from the United States to supply the demands of the Philippine market.

Señor Oses gives a very interesting account of the cultivated varieties of the peanut plant, so far as they are known, as well as the many uses to which the different parts of it are put; for example, the use of the stems and leaves as forage or food for live stock, and the consumption of the beans as a food by the natives in some sections of Africa. The beans are eaten either green or roasted; they are also used in the manufacture of candies and confections by confectioners. In addition to these uses, Señor Oses states that housewives frequently grind them up and use them in making very palatable creams, puddings, etc.; that when mixed with milk and rice a very appetizing sweet is made; that the flour from the ground peanut bean mixed with an equal quantity of wheat flour, together with yeast and salt, is used to make bread and biscuits; that peanut flour is also mixed with equal parts of flour of cassava or "camoteng cahoy" and when well kneaded and baked makes a very palatable

bread which is an excellent food, while the beans when roasted and mixed with three parts of ground cacao beans make a paste from which chocolate is prepared that is said to be especially good for mothers. In addition to these uses, one of the most important is the use made of the oil which when mixed with olive oil is sold under the name of olive oil; for this product there is an increasing demand, while the residue of the peanut or bean is valued as a fertilizer, particularly for lands on which peanuts are to be raised.

Señor Oses gives a careful discussion of the necessary climatic conditions for peanut culture, the soils and fertilizers which should be used, as well as a very careful and pertinent discussion of the preparation and cultivation of the land, including the selection and planting of seed, the common diseases and enemies of the peanut plant, together with the methods of harvesting and drying, also an estimate of the cost of production and the receipts from the crop, showing the profits which may be obtained from the industry. From all of the conditions laid down for the successful cultivation of the peanut plant we should conclude that it would be an easy matter for enterprising agriculturalists in the Philippines, following the instructions laid down by Señor Oses in this article, to supply the demand of the Philippine market and thus put into circulation in these Islands the considerable sums which are now going principally to China and, on a smaller scale, to the United States for this product.

HOW TO TRANSPLANT A TREE.

By Harold Cuzner, *Horticulturist.*

A tree should be transplanted at the period of its life when it is liable to receive the smallest possible injury. This, in this country, is as a general rule at the beginning of the rainy season; except in case the transplanting is to be done at the close of the rainy season before the soil begins to get dry.

If the trees are very young when transplanted they may be dug up carefully, taking care not to injure the roots, and set out where desired. If the trees are of large size it will be found that they will stand moving much better if the roots are pruned several months before taking them up. In large nurseries this is done by an L-shaped blade of steel attached to a plow beam which is run along rather close to the trees cutting the roots, but when only a small number are to be handled the same thing may be accomplished by running a spade down on all sides of the young tree. After this has been done the trees should be left standing where they were growing and the cut surfaces will heal over and put out a number of new small roots which can be preserved when the tree is dug up later on, when it will be found to stand the transplanting with much less injury than if not so treated.

When trees are to be moved but a short distance, they may be taken up with large balls of earth adhering to their roots to prevent their drying out; if this is carefully done the tree will continue to grow without any apparent check.

When trees are to be shipped some distance, however, this becomes impracticable and in this case the roots, as soon as the trees are dug up, should be immediately plunged into a mixture of clay and water about the consistency of thick cream. This mixture is known as "puddle." It has the effect of coating the roots with a layer of mud that prevents the air from drying them out as rapidly as they otherwise would. The trees should then be packed closely in moist sphagnum or wet straw and sent as quickly as possible to their destination.

When the trees are received, if they have been shipped some distance, the bales should be opened up at once and be "heeled in," i. e., set close together in a trench deep enough to take in the roots and part of the stem.

This may be easily done by digging one trench and throwing all of the soil on one side close to the trench. Then set in a row of trees close together and dig soil from the side of the trench opposite to that on which the soil was thrown to cover the roots. In this way a second trench will be formed parallel to the first which will be ready for a second row of trees. The soil should be moist and packed well around the roots, treading it down with the feet. If the trees look at all withered it would be well to have water thrown all over them. The site selected for "heeling in" the trees should be well drained and accessible to the place where the permanent planting is to be made so that they may be pulled out and set as fast as possible.

Before planting, any bruised or injured roots should be cut off with a sharp knife so as to leave a clean smooth surface that will heal over quickly. The cut should be made so that the cut surface will be facing downward rather than to the side or upward.

Some trees are very sensitive to transplanting and will not grow readily even though the above directions are followed. Among these is the *Cassia florida,* which often fails to grow even though the trees are not more than 5 feet tall and are taken up with a ball of earth 18 inches in diameter, unless great care is taken not to break this ball of earth; while others, like the rain tree, will stand very rough handling.

It will be found, however, that for the great majority of trees the above method will give good results if the planting is well done. The holes must be dug in accordance with the size of the tree to be set out, but in no case should the holes be so small as to cramp the roots of the tree, and they should be deep enough to allow the tree to be set 1 or 2 inches deeper than it originally grew. The soil should be well worked in about the roots and packed firm, but not hard. However, the top layer of soil, to a depth of 2 or 3 inches, should be left loose to act as a mulch and prevent the loss of water from the surface by evaporation. As a general rule one or two years' old seedlings will be found to be the best for transplanting, and older trees should be used only where for some reason it is necessary or urgent to secure results, as the expense of handling large trees is considerable, and the chances of success are smaller.

ORANGE CULTIVATION IN BATANGAS PROVINCE.

By MARIANO M. CRUZ, *Agricultural Assistant.*

The chief orange districts in Batangas are those of Santo Tomás and Tanauan which are both situated in the northeast part of the province. It is some five score or more years since the orange was first known in these localities, and it is believed that it was probably introduced from China. There were at first only about 25 growers and the oranges were very cheap, selling at from 10 to 15 centavos a hundred.

The important crops that used to be grown in connection with the orange were coffee, coconut, and sugar cane. Now that the people have been compelled to abandon the growing of coffee and coconuts on account of the diseases and insects, and because they have lost almost all of their work animals used for the cultivation of sugar cane, many people have completely turned their energies toward the orange industry.

It is estimated that of the 10,017,800 oranges grown on 871 hectares in the entire Philippine Archipelago, Batangas alone produced 6,211,500 from 547 hectares, chiefly in Tanauan as its soil is better adapted to this industry than that of Santo Tomás. The feeling of the people toward agricultural development is more intense than ever before. It has been suggested that the Philippine Legislature must and ought to vote annually for larger appropriations for the Bureau of Agriculture in order that the officials of this Bureau may more fully and thoroughlly carry on the work which they have so intelligently and conscientiously undertaken.

KINDS RAISED.

There are two varieties of oranges found in Santo Tomás and Tanauan, namely, "naranjita" and "cajel," the latter being very much less grown on account of the little demand. So that we are more interested in the "naranjita" just now; however, it is hoped that a larger demand for the "cajel" may be created in the future.

GROWING THE YOUNG TREES.

The young seedlings of the orange are usually bought at ₱12 to ₱15 per hundred, when they are about 2 or 3 years old; but there is less expense on the part of the grower should he raise the plants himself as can be seen by the following account: for sowing seeds in pots, one man

at ₱0.60 a day, for one day ₱0.60; for preparing seed beds, two men at ₱0.60 a day, for two days, ₱2.40. The seeds are collected from any fruit found near at hand, without paying attention to the proper selection of seed; following this plan the desirable qualities of the orange will not be improved for a long time, in fact it may be said that such qualities are now being spoiled to some degree. The seeds are sown in large earthen pots about February and planted about 28 to 35 centimeters apart about June or July in a well-prepared seed bed of about 7 meters wide by 12 meters long. The young plants are allowed to remain in this bed until they are 2 or 3 years old, when they are transplanted in a field of a sandy-loam soil, at a distance of from 5 to 8 meters from each other. In transplanting advantage is taken of the rainy season, so that there will be no necessity for artificial irrigation. In order that the field may be kept free from "cogon" it is sometimes sown to rice, corn, peanuts, or mongo for six years while the orange trees are not bearing; these crops rather more than pay the cost of cultivating the land during the six years.

About May or June of the seventh year of growth, the orange trees will begin to bloom, and ripen their first fruit from September to December. At present this fruit brings from 30 to 40 centavos a hundred on the tree. The purchaser harvesting and transporting the crop to Calamba, Laguna, the nearest present port, where they sell at ₱0.60 to ₱1 per hundred, after paying about ₱8 to ₱11 per carreton for carting—a carreton will carry from four to six baskets containing 500 oranges each. Though this method of transportation is normally slow it is made worse by the existing bad condition of that portion of the road belonging to the Province of La Laguna, and the growers are patiently looking forward to the time when their oranges can be transported by the railroad which should soon be completed.

CARE OF THE TREES.

In growing oranges, such work as cultivating and manuring the soil and pruning the trees is almost wholly unknown, making the trees less productive and propably less able to resist the attacks of insects and diseases. The land about the orange trees should be cultivated every dry season, beginning when the trees are first set out so as to cover and protect their roots from the heat of the sun and to render the elements of plant food in the soil more available. It is the belief of some people that animal manure burns the roots of the trees, thus killing them; of course, this is partially true if the manure is applied when it is fresh, but should it be applied after it has well rotted, about 2 feet from the trees, the result would be decidedly beneficial. In this connection, commercial fertilizers could be used to good advantage by applying to each tree about 2 or 3 pounds of fertilizer containing from 6 to 8 per cent of phosphoric

acid, from 8 to 12 per cent of potash, and 3½ to 4 per cent of nitrogen, as in the following formulas:

	Pounds.
For young trees:	
Acid phosphate	800
Sulphate of potash	314
Nitrate of soda	500
For bearing trees:	
Acid phosphate	1,066
Sulphate of potash	470
Nitrate of soda	466

The above formulas are recommended by H. Harold Hume, of the University of Florida, in his book on "Citrus Fruits and Their Culture." On examination we find that the consumption of nitrogenous material is decreased as the trees become older; this is due to the fact that nitrogen is used mainly in the production of vigorous leaves and branches while the trees are young; and in turn the potash and phosphoric compounds are increased while the trees become older as these elements are largely used in the production of fruit. In using all kinds of fertilizers it should be remembered that the soil must first be cultivated, otherwise a crust will be formed on the surface of the soil making the fertilizer unavailable for the trees.

For the purpose of checking the growth of certain portions of the tree or causing the crown to spread it is a common practice to hang stones from the branches or place them in the crotch between the main branches. While this may accomplish the desired result to a certain degree, a careful pruning of the extra and undesirable branches will accomplish the desired results in a much more satisfactory manner.

ENEMIES AND DISEASES.

While several orange diseases have been found, a gummosis disease, "lumuluha," which attacks the lower portion of the trees, producing tears of a gummy substance, is probably the most important one. The best remedy so far known for this disease is simply cutting off smoothly the infected portion and applying to it afterwards an antiseptic lime wash. The insects that are oftentimes troublesome are, first, the "atañga," a fly which attacks the fruit stalks and causes the oranges to drop off in great numbers; then, the "uhod," probably the larva of a small beetle which generally attacks the portion of the trunk affected with gummosis by eating its way into the bark and wood; about 10 to 20 per cent of these trees are destroyed inside of from three to five years. The bearing period of the trees continues until they are about 30 or 35 years old. To drive away the "atañga" the people smudge the trees by burning rubbish under them which probably does some good; but the best remedy would probably be to spray the trees with a Paris green solution while the fruits are still young. In the case of the "uhod," whitewashing the trunk or

painting the trunk with tree tangle-foot would probably be the most effective. Another common pest in the orange groves of the province is the "dapu" (mistletoe), a parasitic plant which eventually kills the branches it attacks. To destroy the "dapu" it is best to gather it all and burn it completely so as to avoid further production of its seeds. Large numbers of oranges are lost through heavy winds, but much of the damage could be avoided by the use of windbreaks. There are many native trees which might serve the purpose, among which are the "agoho" (*Casuarina equisetifolia*) and "madre cacao" (*Glircida maculata*).

PRINCIPAL ORCHARDS.

The most important barrios growing oranges in Santo Tomás are San Vicente, San Roque, San Pedro, San Pablo, San Felix, and San Jose, all of which are situated southeast of the town; and the principal orange growers are Señores Miguel Malvar, Eustacio Maloles, Máximo Malvar, Victoriano Villegas, Arcadio Sanchez, and Pedro Torres. In this connection, I might say a few words concerning General Malvar, with whom I had the honor to speak about the orange industry. General Malvar is one of the most energetic, if not the first, of Filipino agriculturists. It is to him that I am indebted for most of my data in this paper.

In Tanauan the important barrios engaged in this industry are Boncolot, Natatas, Balele, Boot, Santor and Janopol; while the principal growers are Doña Jacoba Garcia, Sr. Sixto Castillo, Sr. Prospero Dimayuga, Sr. Nicolás González, Sr. Ruperto Laurel, Señora María Tapia, and others. The average size of an orange grove in bearing in both places ranges from 15 ares to about 75 ares (from about one-third acre to about 1¾ acres); but seven years hence it is estimated that the groves will be more than double that size.

COST OF CULTIVATION.

In discussing the orange industry of Batangas an estimate of the expense of an orange grove of 1 hectare will doubtless be of interest.

EXPENSES THE FIRST YEAR.

One hectare of land, ₱80 to ₱150	₱115.00
Tools, "tactac" (small crowbar), ₱0.40; "dulos" (hoe), ₱0.80; "taisin" (weeder), ₱0.50, and bolo, ₱1.20	2.90
Clearing of land, 5 men at ₱0.60 a day for six days	18.00
150 young trees, ₱10 per hundred, and planting at ₱0.03 per tree	19.50
Land tax for six years at six-eighths of 1 per cent of the assessed value	5.16
Total expense	160.56

EXPENSES SEVENTH YEAR.

Tax at six-eighths of 1 per cent on valuation	₱0.86
Weeding, cleaning, etc	7.87
Total expense	8.73

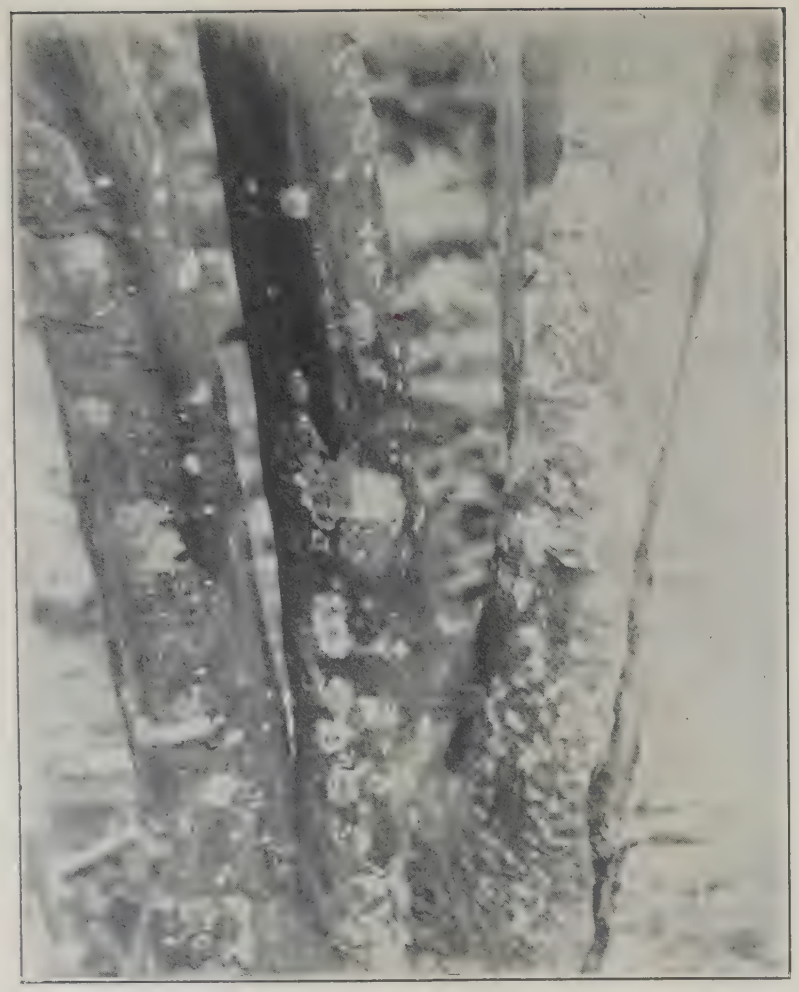

PLATE II.—(*a*) THE EFFECT OF THE "DAPU" A PARASITIC GROWTH ON THE ORANGE TREES IN BATANGAS.

PLATE II.—(*b*) THE EFFECT OF "UHOD" OR WORMS WHICH EAT INTO THE TRUNKS OF THE ORANGE TREES.

INCOME SEVENTH YEAR.

From 140 to 160 trees, at 20 to 100 fruits each, giving 9,000 fruits, at ₱0.30 a hundred	₱31.50
Total expense	8.73
Net profit	22.77

EXPENSES TENTH YEAR.

Tax at six-eighths of 1 per cent on valuation	₱0.86
Weeding, cleaning, etc	72.18
Total expense account	73.04

INCOME TENTH YEAR.

From 140 to 160 trees, at 200 to 900 fruits each, giving altogether 82,500 fruits, at ₱0.30 to ₱0.40 a hundred	₱288.75
Total expense	73.04
Net profit	215.71

EXPENSES FIFTEENTH YEAR.

Tax at six-eighths of 1 per cent on valuation	₱0.88
Weeding, cleaning, etc	335.62
Total expenses	336.48

INCOME FIFTEENTH YEAR.

From 140 to 160 trees, at 1,000 to 4,000 each, giving altogether 375,000 fruits, at ₱0.30 to ₱0.40 a hundred	₱1,312.50
Total expense	336.48
Net profit	976.02

NEW VARIETIES NEEDED.

Probably the most important thing that could be suggested toward the improvement of the orange industry in Batangas is the extension of the season by the introduction or creation of early and late varieties of oranges. A late variety might prove particularly satisfactory as its fruit would be welcomed during the long, hot, dry season. But such work, however, can not be done in a single year as it requires careful breeding and selection so that in all probability it would take about fifteen years, more or less, to obtain definite results. For this reason it is rather difficult for the private individual to undertake the work, and it would be highly desirable to have a Government station in the neighborhood where such work could be systematically carried on. Should this plan be carried out, other questions, such as those of cultivation, fertilizers, pruning, combating of insects and diseases, windbreaks, irrigation, storage, uses, etc., could all be studied at the same time. Such a station as this must and ought to be encouraged by all who are really interested in the agricultural development of the country. The growers ought to

form an association for the promotion of the industry, and there seems to be no reason why it could not be so developed as to have an export rather than an import trade. At present hundreds of thousand of oranges are imported annually into this country from China, California, and other countries of the world, where orange growing is done on a commercial basis.

THE MAN WHO WORKS WITH HIS HANDS.[1]

By Theodore Roosevelt.

OUR EDUCATIONAL SYSTEM AND WHAT IT LACKS.

As a people there is nothing in which we take a juster pride than our educational system. It is our boast that every boy or girls has the chance to get a school training; and we feel it is a prime national duty to furnish this training free, because only thereby can we secure the proper type of citizenship in the average American. Our public schools and our colleges have done their work well, and there is no class of our citizens deserving of heartier praise than the men and women who teach in them.

Nevertheless, for at least a generation we have been waking to the knowledge that there must be additional education beyond that provided in the public school as it is managed to-day. *Our school system has hitherto been well-nigh wholly lacking on the side of industrial training, of the training which fits a man for the shop and the farm. This is a most serious lack, for no one can look at the peoples of mankind as they stand at present without realizing that industrial training is one of the most potent factors in national development.* We of the United States must develop a system under which each individual citizen shall be trained so as to be *effective individually as an economic unit,* and fit to be organized with his fellows so that he and they can work in efficient fashion together. This question is vital to our future progress, and public attention should be focused upon it. Surely it is eminently in accord with the principles of our democratic life that we should furnish the highest average industrial training for the ordinary skilled workman. *But it is a curious thing that in industrial training we have tended to devote our energies to producing high-grade men at the top rather than in the ranks.* Our engineering schools, for instance, compare favorably with the best in Europe, whereas *we have done almost nothing to equip the private soldiers of the industrial army*—the mechanic, the metal-worker, the carpenter. *Indeed, too often our schools train away from the shop and the forge; and this fact, together with the abandonment of the old apprentice system, has resulted in such an absence of facilities for providing trained journeymen that in many of our trades almost all*

[1] Circular No. 24, United States Department of Agriculture.

the recruits among the workmen are foreigners. Surely this means that there must be some systematic method provided for training young men in the trades, and that this must be coördinated with the public school system. No industrial school can turn out a finished journeyman; but it can furnish the material out of which a finished journeyman can be made, just as an engineering school furnishes the training which enables its graduates speedily to become engineers.

We hear a great deal of the need of protecting our workingmen from competition with pauper labor. I have very little fear of the competition of pauper labor. The nations with pauper labor are not the formidable industrial competitors of this country. *What the American workingman has to fear is the competition of the highly skilled workingman of the countries of greatest industrial efficiency.* By the tariff and our immigration laws we can always protect ourselves againt the competition of pauper labor here at home; but when we contend for the markets of the world we can get no protection, and we shall then find that our most formidable competitors are the nations in which there is the most highly developed business ability, the most highly developed industrial skill; and these are the qualities which we must ourselves develop.

DIGNITY AND IMPORTANCE OF LABOR.

We have been fond as a Nation of speaking of the dignity of labor, meaning thereby manual labor. Personally I don't think that we begin to understand what a high place manual labor should take; and it never can take this high place unless it offers scope for the best type of man. *We have tended to regard education as a matter of the head only, and the result is that a great many of our people, themselves the sons of men who worked with their hands, seem to think that they rise in the world if they get into a position where they do no hard manual work whatever; where their hands will grow soft, and their working clothes will be kept clean. Such a conception is both false and mischievous.* There are, of course, kinds of labor where the work must be purely mental, and there are other kinds of labor where, under existing conditions, very little demand indeed is made upon the mind, though I am glad to say that I think the proportion of men engaged in this kind of work is diminishing. But in any healthy community, in any community with the great solid qualities which alone make a really great nation, the bulk should do work which makes demands upon both the body and the mind. Progress can not permanently consist in the abandonment of physical labor, but in the development of physical labor so that it shall represent more and more the work of the trained mind in the trained body. To provide such training, to encourage in every way the production of the men whom it alone can produce, is to show that as a nation we have a true conception of the dignity and importance of labor. *The calling of the skilled tiller*

of the soil, the calling of the skilled mechanic, should alike be recognized as professions, just as emphatically as the calling of lawyer, of doctor, of banker, merchant, or clerk. The printer, the electrical worker, the house painter, the foundry man, should be trained just as carefully as the stenographer or the drug clerk. They should be trained alike in head and in hand. They should get over the idea that to earn twelve dollars a week and call it "salary" is better than to earn twenty-five dollars a week and call it "wages." The young man who has the courage and the ability to refuse to enter the crowded field of the so-called professions and to take to constructive industry is almost sure of an ample reward in earnings, in health, in opportunity to marry early, and to establish a home with reasonable freedom from worry. We need the training, the manual dexterity, and industrial intelligence which can be best given in a good agricultural, or building, or textile, or watchmaking, or engraving, or mechanical school. It should be one of our prime objects to put the mechanic, the wage-worker who works with his hands, and who ought to work in constantly larger degree with his head, on a higher plane of efficiency and reward, so as to increase his effectiveness in the economic world, and therefore the dignity, the remuneration, and the power of his position in the social world. *To train boys and girls in merely literary accomplishments to the total exclusion of industrial, manual, and technical training tends to unfit them for industrial work; and in real life most work is industrial.*

The problem of furnishing well-trained craftsmen, or rather journeymen fitted in the end to become such, is not simple—few problems are simple in the actual process of their solution—and much care and forethought and practical common sense will be needed, in order to work it out in a fairly satisfactory manner. It should appeal to all our citizens. I am glad that societies have already been formed to promote industrial education, and that their membership includes manufacturers and leaders of labor unions, educators and publicists, men of all conditions who are interested in education and in industry. It is such coöperation that offers most hope for a satisfactory solution of the question as to what is the best form of industrial school, as to the means by which it may be articulated with the public school system, and as to the way to secure for the boys trained therein the opportunity to acquire in the industries the practical skill which alone can make them finished journeymen.

THE FARMER IN RELATION TO THE WELFARE OF THE WHOLE COUNTRY.

There is but one person whose welfare is as vital to the welfare of the whole country as is that of the wage-worker who does manual labor, and that is the tiller of the soil—the farmer. If there is one lesson taught by history it is that *the permanent greatness of any State must ultimately depend more upon the character of its country population*

than upon anything else. No growth of cities, no growth of wealth, can make up for a loss in either the number or the character of the farming population. In the United States more than in almost any other country we should realize this and should prize our country population. When this Nation began its independent existence it was as a Nation of farmers. The towns were small and were for the most part mere seacoast trading and fishing ports. The cheif industry of the country was agriculture, and the ordinary citizen was in some way connected with it. In every great crisis of the past a peculiar dependence has had to be placed upon the farming population; and this dependence has hitherto been justified. But it can not be justified in the future if agriculture is permitted to sink in the scale as compared with other employments. We can not afford to lose that preëminently typical American, *the farmer who owns his own farm.*

ECONOMIC AND SOCIAL FACTORS AFFECTING RURAL POPULATIONS.

Yet it would be idle to deny that in the last half century there has been in the eastern half of our country a falling off in the relative condition of the tillers of the soil, although signs are multiplying that the Nation has waked up to the danger and is preparing to grapple effectively with it. East of the Mississippi and north of the Ohio and the Potomac there has been on the whole an actual shrinkage in the number of the farming population since the civil war. In the States of this section there has been a growth of population—in some an enormous growth—but the growth has taken place in the cities, and especially in the larger cities. This has been due to certain economic factors, such as the extension of railroads, the development of machinery, and the openings for industrial success afforded by the unprecedented growth of cities. The increased facility of communication has resulted in the withdrawal from rural communities of most of the small, widely distributed manufacturing and commercial operations of former times, and the substitution therefor of the centralized commercial and manufacturing industries of the cities.

The chief offset to the various tendencies which have told against the farm has hitherto come in the rise of the physical sciences and their application to agricultural practices or to the rendering of country conditions more easy and pleasant. But these countervailing forces are as yet in their infancy. As compared with a few decades ago, the social or community life of country people in the East compares less favorably than it formerly did with that of the dwellers in cities. Many country communities have lost their social coherence, their sense of community interest. In such communities the country church, for instance, has gone backward both as a social and a religious factor. Now, we can not too strongly insist upon the fact that it is quite as unfortunate to have any social as well as any economic falling off. It would be a calamity to have our farms occupied by a lower type of people than the hard-

working, self-respecting, independent, and essentially manly men and womanly women who have hitherto constituted the most typically American, and on the whole the most valuable, element in our entire Nation. Ambitious native-born young men and women who now tend away from the farm must be brought back to it, and therefore they must have social as well as economic opportunities. Everything should be done to encourage the growth in the open farming country of such institutional and social movements as will meet the demand of the best type of farmers. *There should be libraries, assembly halls, social organizations of all kinds. The school building and the teacher in the school building should, throughout the country districts, be of the very highest type, able to fit the boys and girls not merely to live in but thoroughly to enjoy and to make the most of the country. The country church must be revived. All kinds of agencies, from rural free delivery to the bicycle and the telephone, should be utilized to the utmost; good roads should be favored; everything should be done to make it easier for the farmer to lead the most active and effective intellectual, political, and economic life.*

There are regions of large extent where all this, or most of this, has already been realized; and while this is perhaps especially true of great tracts of farming country west of the Mississippi, with some of which I have a fairly intimate personal knowledge, it is no less true of other great tracts of country east of the Mississippi. In these regions the church and the school flourish as never before; there is a more successful and more varied farming industry; the social advantages and opportunities are greater than ever before; life is fuller, happier, more useful; and though the work is more effective than ever, and in a way quite as hard, it is carried on so as to give more scope for well-used leisure. My plea is that we shall all try to make more nearly universal the conditions that now obtain in the most favored localities.

PROGRESS IN AGRICULTURAL SCIENCE.

Nothing in the way of scientific work can ever take the place of business management on a farm. We ought all of us to teach ourselves as much as possible; but we can also all of us learn from others; and the farmer can best learn how to manage his farm even better than he now does by practice, under intelligent supervision, on his own soil in such a way as to increase his income. This is the kind of teaching which has been carried on in Texas, Louisiana, and Arkansas by Doctor Knapp, of the National Department of Agriculture. But much has been accomplished by the growth of what is broadly designated as agricultural science. This has been developed with remarkable rapidity during the last quarter of a century, and the benefit to agriculture has been great. As was inevitable, there was much error and much repetition of work in the early application of money to the needs of agricultural

colleges and experiment stations alike by the Nation and the several States. Much has been accomplished; but much more can be accomplished in the future. The prime need must always be for real research, resulting in scientific conclusions of proved soundness. Both the farmer and the legislature must beware of invariably demanding immediate returns from investments in research efforts. It is probably one of our faults as a Nation that we are too impatient to wait a sufficient length of time to accomplish the best results; and in agriculture effective research often, although not always, involves slow and long-continued effort if the results are to be trustworthy. While applied science in agriculture as elsewhere must be judged largely from the standpoint of its actual return in dollars, yet the farmers no more than anyone else can afford to ignore the large results that can be enjoyed because of broader knowledge. The farmer must prepare for using the knowledge that can be obtained through agricultural colleges by insisting upon a constantly more practical curriculum in the schools in which his children are taught. He must not lose his independence, his initiative, his rugged self-sufficiency; and yet he must learn to work in the heartiest coöperation with his fellows.

EDUCATIONAL AND RESEARCH WORK OF THE DEPARTMENT OF AGRICULTURE.

The corner stones of our unexampled prosperity are, on the one hand, *the production of raw material,* and *its manufacture and distribution* on the other. These two great groups of subjects are represented in the National Government principally by the Departments of Agriculture and of Commerce and Labor. The production of raw material from the surface of the earth is the sphere in which the Department of Agriculture has hitherto achieved such notable results. *Of all the Executive Departments there is no other, not even the Post-Office, which comes into more direct and beneficent contact with the daily life of the people than the Department of Agriculture, and none whose yield of practical benefits is greater in proportion to the public money expended.*

But great as its services have been in the past, the Department of Agriculture has a still larger field of usefulness ahead. It has been dealing with growing crops. It must hereafter deal also with living men. *Hitherto agricultural research, instruction, and agitation have been directed almost exclusively toward the production of wealth from the soil.* It is time to adopt in addition a new point of view. *Hereafter another great task before the National Department of Agriculture and the similar agencies of the various States must be to foster agriculture for its social results, or, in other words, to assist in bringing about the best kind of life on the farm for the sake of producing the best kind of men.* The Government must recognize the far-reaching importance of the study and treatment of the problems of farm life alike from the social and the economic

standpoints; and the Federal and State Departments of Agriculture should coöperate at every point.

The farm grows the raw material for the food and clothing of all our citizens; it supports directly almost half of them; and nearly half the children of the United States are born and brought up on farms. How can the life of the farm family be made less solitary, fuller of opportunity, freer from drudgery, more comfortable, happier, and more attractive? Such a result is most earnestly to be desired. *How can life on the farm be kept on the highest level, and where it is not already on that level, be so improved, dignified, and brightened as to awaken and keep alive the pride and loyalty of the farmer's boys and girls, of the farmer's wife, and of the farmer himself? How can a compelling desire to live on the farm be aroused in the children that are born on the farm?* All these questions are of vital importance not only to the farmer but to the whole Nation; and the Department of Agriculture must do its share in answering them.

The drift toward the city is largely determined by the superior social opportunities to be enjoyed there, by the greater vividness and movement of city life. Considered from the point of view of national efficiency, the problem of the farm is as much a problem of attractiveness as it is a problem of prosperity. It has ceased to be merely a problem of growing wheat and corn and cattle. The problem of production has not ceased to be fundamental, but it is no longer final; just as learning to read and write and cipher are fundamental, but are no longer the final ends of education. We hope ultimately to double the average yield of wheat and corn per acre; it will be a great achievement; but it is even more important to double the desirability, comfort, and standing of the farmer's life.

We must consider, then, not merely how to produce, but also how production affects the producer. In the past we have given but scant attention to the social side of farm life. We should study much more closely than has yet been done the social organization of the country, and inquire whether its institutions are now really as useful to the farmer as they should be, or whether they should not be given a new direction and a new impulse, for no farmer's life should lie merely within the boundary of his farm. This study must be of the East and the West, the North and the South; for the needs vary from place to place.

First in importance, of course, comes the effort to secure the mastery of production. Great strides toward this end have already been taken over the larger part of the United States; much remains to be done, but much has been done; and the debt of the Nation to the various agencies of agricultural improvement for so great an advance is not to be overstated. But we can not halt here. The benefits of high social organization include such advantages as ease of communication, better educational facilities, increased comfort of living, and those opportunities for

social and intellectual life and intercourse, of special value to the young people and to women, which are as yet chiefly to be had in centers of population. All this must be brought within the reach of the farmers who live on the farms, of the men whose labor feeds and clothes the towns and cities.

BENEFITS RESULTING FROM COÖPERATION.

Farmers must learn the vital need of coöperation with one another. Next to this comes coöperation with the Government, and the Government can best give its aid through associations of farmers rather than through the individual farmer; for there is no greater agricultural problem than that of delivering to the farmer the large body of agricultural knowledge which has been accumulated by the National and State Governments and by the agricultural colleges and schools. Nowhere has the Government worked to better advantage than in the South, where the work done by the Department of Agriculture in connection with the cotton growers of the Southwestern States has been phenomenal in its value. The farmers in the region affected by the boll weevil, in the course of the efforts to fight it, have succeeded in developing a most scientific husbandry, so that in many places the boll weevil became a blessing in disguise. Not only did the industry of farming become of very much greater economic value in its direct results, but it became immensely more interesting to thousands of families. The meetings at which the new subjects of interest were discussed grew to have a distinct social value, while with the farmers were joined the merchants and bankers of the neighborhood. It is needless to say that every such successful effort to organize the farmer gives a great stimulus to the admirable educational work which is being done in the Southern States, as elsewhere, to prepare young people for an agricultural life. It is greatly to be wished that the communities whence these students are drawn and to which they either return or should return could be coöperatively organized; that is, that associations of farmers could be organized, primarily for business purposes, but also with social ends in view. This would mean that the returned students from the institutions of technical learning would find their environment prepared to profit to the utmost by the improvements in technical methods which they had learned.

The people of our farming regions must be able to combine among themselves, as the most efficient means of protecting their industry from the highly organized interests which now surround them on every side. A vast field is open for work by coöperative associations of farmers in dealing with the relation of the farm to transportation and to the distribution and manufacture of raw materials. It is only through such combination that American farmers can develop to the full their economic and social power. Combination of this kind has, in Denmark, for instance, resulted in bringing the people back to the land, and has enabled

the Danish peasant to compete in extraordinary fashion, not only at home but in foreign countries, with all rivals.

KIND OF EDUCATION NEEDED.

Agricultural colleges and farmers' institutes have done much in instruction and inspiration; they have stood for the nobility of labor and the necessity of keeping the muscles and the brain in training for industry. They have developed technical departments of high practical value. They seek to provide for the people on the farms an equipment so broad and thorough as to fit them for the highest requirements of our citizenship; so that they can establish and maintain country homes of the best type, and create and sustain a country civilization more than equal to that of the city. The men they train must be able to meet the strongest business competition, at home or abroad, and they can do this only if they are trained not alone in the various lines of husbandry but in successful economic management. These colleges, like the State experiment stations, should carefully study and make known the needs of each section, and should try to provide remedies for what is wrong.

The education to be obtained in these colleges should create as intimate relationship as is possible between the theory of learning and the facts of actual life. Educational establishments should produce highly trained scholars, of course; but in a country like ours, where the educational establishments are so numerous, it is folly to think that their main purpose is to produce these highly trained scholars. Without in the least disparaging scholarship and learning—on the contrary, while giving hearty and ungrudging admiration and support to the comparatively few whose primary work should be creative scholarship—*it must be remembered that the ordinary graduate of our colleges should be and must be, primarily, a man and not a scholar. Education should not confine itself to books. It must train executive power, and try to create that right public opinion which is the most potent factor in the proper solution of all political and social questions.* Book-learning is very important, but it is by no means everything; and *we shall never get the right idea of education until we definitely understand that a man may be well trained in book-learning and yet, in the proper sense of the word and for all practical purposes, be utterly uneducated; while a man of comparatively little book-learning may, nevertheless, in essentials have a good education.*

IMPROVEMENT OF CONDITIONS AFFECTING COUNTRY LIFE.

It is true that agriculture in the United States has reached a very high level of prosperity; but we can not afford to disregard the signs which teach us that there are influences operating against the establishment or retention of our country life upon a really sound basis. The over-extensive and wasteful cultivation of pioneer days must stop and give place

to a more economical system. Not only the physical but the ethical needs of the people of the country districts must be considered. In our country life there must be social and intellectual advantages as well as a fair standard of physical comfort. *There must be in the country, as in the town, a multiplication of movements for intellectual advancement and social betterment. We must try to raise the average of farm life, and we must also try to develop it so that it shall offer exceptional chances for the exceptional man.*

Of course the essential things after all are those which concern all of us as men and women, no matter whether we live in the town or the country, and no matter what our occupations may be. The root problems are much the same for all of us, widely though they may differ in outward manifestation. The most important conditions that tell for happiness within the home are the same for the town and the country; and the relations between employer and employee are not always satisfactory on the farm any more than in the factory. All over the country there is a constant complaint of paucity of farm labor. Without attempting to go into all the features of this question I would like to point out that you can never get the right kind, the best kind, of labor if you offer employment only for a few months, for no man worth anything will permanently accept a system which leaves him in idleness for half the year.

A WORD REGARDING THE FARMER'S FAMILY.

And most important of all, I want to say a special word on behalf of the one who is too often the very hardest worked laborer on the farm—the farmer's wife. Reform, like charity, while it should not end at home, should certainly begin there; and the man whether he lives on a farm or in a town, who is anxious to see better social and economic conditions prevail through the country at large, should be exceedingly careful that they prevail first as regards his own womankind. I emphatically believe that for the great majority of women the really indispensable industry in which they should engage is in the industry of the home. *There are exceptions, of course; but exactly as the first duty of the normal man is the duty of being the home-maker, so the first duty of the normal woman is to be the home-keeper; and exactly as no other learning is as important for the average man as the learning which will teach him how to make his livelihood, so no other learning is as important for the average woman as the learning which will make her a good housewife and mother.* But this does not mean that she should be an overworked drudge. I have hearty sympathy with the movement to better the condition of the average tiller of the soil, of the average wageworker, and I have an even heartier sympathy and applause for the movement which is to better the condition of their respective wives. There is plenty that is hard and rough and disagreeable in the necessary

work of actual life; and under the best circumstances, and no matter how tender and considerate the husband, the wife will have at least her full share of work and worry and anxiety; but if the man is worth his salt he will try to take as much as possible of the burden off the shoulders of his helpmate. There is nothing Utopian in the movement; all that is necessary is to strive toward raising the average, both of men and women, to the level on which the highest type of family now stands, among American farmers, among American skilled mechanics, among American citizens generally; for *in all the world there is no better and healthier home life, no finer factory of individual character, nothing more representative of what is best and most characteristic in American life than that which exists in the higher type of American family; and this higher type of family is to be found everywhere among us, and is the property of no special group of citizens.*

The best crop is the crop of children; the best products of the farm are the men and women raised thereon; and the most instructive and practical treatises on farming, necessary though they be, are no more necessary than the books which teach us our duty to our neighbor, and above all to the neighbor who is of our own household. You young men and women of the agricultural and industrial colleges and schools—and, for that matter, you who go to any college or school—must have some time for light reading; and there is some light reading quite as useful as heavy reading, provided, of course, that you do not read in a spirit of mere vacuity. Aside from the great classics, and thinking only of the many healthy and stimulating books of the day, it is easy to pick out many which can really serve as tracts, because they possess what many avowed tracts and treatises do not, the prime quality of being interesting. You will learn the root principles of self-help and helpfulness toward others from "Mrs. Wiggs of the Cabbage Patch" just as much as from any formal treatise on charity; you will learn as much sound social and industrial doctrine from Octave Thanet's stories of farmers and wage-workers as from avowed sociological and economic studies; and I cordially recommend the first chapter of "Aunt Jane of Kentucky" for use as a tract in all families where the men folks tend to selfish or thoughtless or overbearing disregard of the rights of their womenkind.

Do not misunderstand me. I have not the slightest sympathy with those hysterical and foolish creatures who wish women to attain to easy lives by shirking their duties. I have as hearty a contempt for the woman who shirks her duty of bearing and rearing the children, of doing her full housewife's work, as I have for the man who is an idler, who shirks his duty of earning a living for himself and for his household, or who is selfish or brutal toward his wife and children. *I believe in the happiness that comes from the performance of duty, not from the*

avoidance of duty. But I believe also in trying, each of us, as strength is given us, to bear one another's burdens; and this especially in our own homes. *No outside training, no coöperation, no Government aid or direction can take the place of a strong and upright character; of goodness of heart combined with clearness of head, and that strength and toughness of fiber necessary to wring success from a rough work-a-day world. Nothing outside of home can take the place of home. The school is an inavluable adjunct to the home, but it is a wretched substitute for it.* The family relation is the most fundamental, the most important of all relations. *No leader in church or state, in science or art or industry, however great his achievement, does work which compares in importance with that of the father and the mother, "who are the first of sovereigns and the most divine of priests."*

THE CULTIVATION OF THE PEANUT PLANT.[1]

By Ramón García Osés,
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Peanut growing is being steadily developed because the consumption of peanuts is increasing both at home and abroad. Exportation to foreign countries has already been initiated where peanuts are being used by confectioners for extracting the oil which is sold under the name of olive oil, being mixed with the latter to give it the appearance of olive oil and to get the better profit. The peanut is a very good fertilizer, because it has the power of accumulating nitrogen in the soil, due to a special kind of bacteria which live in the knots of its roots. Since the year 1865 peanut culture has developed considerably in the United States, which formerly imported great quantities of this crop from West Africa. Since that time the States of North Carolina, Tennessee, and Virginia have gradually increased their production, thus diminishing the quantity imported in spite of the increase in consumption.

ORIGIN.

As to the origin of the peanut plant (*Arachis hypogœa*), several American countries claim to be the place; for example Peru, where stringed peanut beans were found in the tombs of the primitive inhabitants. According to De Candolle Yañez Pinzon's companions in 1500, on their arrival in Brazil, found that the Brazilians were already cultivating it; in Mexico, according to Clavijero, the Spaniards found the natives cultivating it. Others believe it is of African origin and claim that it comes from lower Guinea and Senegambia; so that its origin is not well determined, and we can only state that the plant has been cultivated in the hot zones from time immemorial.

VARIETIES.

Up to the present there are few well-defined varieties of this plant. The characteristics of the fruit as well as of the leaves and its production and development in general may establish remarkable differences corresponding to the color and shape of the bean and small differences in

[1] Extracts from Boletin num. 1, Febrero de 1908, Estación Agrícola Experimental de Río Verde, San Luís Potosi, México.

the growing of the stem and the form of the leaf; but it is sure that henceforth, when its varieties have been studied thoroughly, it will be classified according to the quality and quantity of the fruit produced, the richness of fat contained in the bean, and the protein contained in the stems.

Virginia peanut.—This variety produces large beans covered with a white film; it has regular leaves of good flavor which keep for a long time; very leafy branches extend from the principal stem—those which grow upward being smaller than the lateral ones and much less numerous. In Cuba there is also a white variety, which is a native of Africa.

Clarmac yumbec.—This variety comes from Florida; both the leaves and the beans are larger than those of most other varieties. The film covering the bean is yellow or straw colored; the bean is much thicker and shorter, with thicker, smoother and more brilliant hull. In Mexico there are white and reddish varieties, the same as those cultivated in Tennessee.

Spanish variety.—In this class are the purple and white varieties. They are of good flavor and contain a large quantity of oil; they have small leafage, and for this reason they may be cultivated more closely. The fruit grows nearer the roots than those of the Virginia variety and it is harvested earlier.

African variety.—This is more precocious in growing and ripening; its beans are much smaller than the varieties already described; nevertheless, the seeds contain a larger quantity of oil. There are many other varieties in Costa Rica, Argentine Republic, Malay Archipelago, and British India, of which little is known.

Mr. Dumas, agent of cultivation for West Africa, describes the following varieties:

Lótiga.—This variety is characterized by numerous straight branches covered with leaves, 30 to 40 centimeters long, all of which grow toward the center.

Tigadia.—This kind has few creeping branches attaining a length of 50 to 60 centimeters; not so many beans grow near the center of the plant, but they are scattered in groups of from two to three along the branches. This plant gives but a small yield.

Sogobatiga.—This variety has very well-developed beans, from 3 to 4 centimeters long, which hang from two or three axils of the leaves.

Fila tiga.—This species has small beans but is nevertheless very productive.

USES.

The dry stems, beside being good food for live stock, are used in manufacturing paper; the beans are eaten either green or roasted; they are also used in the manufacture of candies; when ground and allowed

to thicken very palatable creams, puddings, etc., are prepared from them; when mixed with milk and rice exquisite sweets are made. Peanut oil, owing to its flavor and other good qualities, may be used as a substitute for lard; when the ground beans are dried and made into flour, mixed in equal parts with wheat flour, with yeast and salt added, bread and biscuits are made—a good palatable food that can be preserved for a long time.

The beans of the peanut when roasted and mixed with three parts of ground cacao beans makes a paste from which a chocolate is prepared that is said to be especially good for mothers. Both the beans and the residue after the oil has been extracted constitute a nourishing food for fowls, making their flesh tender and succulent so that it tastes much like the meat of the partridge. The residue which remains after the oil has been extracted is sometimes mixed with ground corn and makes a good food for fattening pigs, horses, and cattle. The ground pod of the peanut is a good absorbent and very easily absorbs molasses, making a palatable and nutritive food for animals. With the flour of the peanut and the cassava or "camoteng cahoy," mixed together in equal parts and well kneaded, a very palatable bread is made which when buttered makes an excellent food. Peanut oil may be easily kept for a long time without growing rancid. It is of a greenish yellow color, without odor and of a sweet flavor, but inferior to olive oil.

CHARACTERISTICS OF THE PLANT AND FRUIT.

This plant dries as the fruit ripens and has a period of growth of about six months. It belongs to the very useful family of the *Leguminosæ* and the subfamily of the *Papilionaceæ;* it is one of those plants the corolla of which looks very much like a butterfly; the Latin name of the plant is "Arachis hipogea"; the first word means branches and the second underground. In Argentine, Japan, Brazil, and France it is known as ground-nut or ground-bean.

The plant is herbaceous, annual, branching, a creeper, scattered, simple in its origin but branching afterwards. It scatters in every direction through the soil, growing usually about 50 centimeters high; its leaves are complete, composed of four oval leaflets arranged two by two; its flower is yellow. The fruit is a coriaceous vegetable, having constrictions or knots which show the location of the beans; having one, two and sometimes four oval-oblong seeds or beans, each one having two cotyledons. The first bean, which is oblong, ends in a point, the second and third are very irregular, and the fourth, when there is one, has a flattened, oblong head; they grow inside of the pod, more or less closely, taking these distinct forms. Each seed is covered with a thin, yellowish film protected by the pod, which has an exterior formed of irregular meshes of intercrossed threads like net; the embryo or the

young plant lies between the cotyledons in the extreme end of the seed. Supposing the bean is hanging from the plant and contains three seeds: the first, that on the higher part, has the embryo between this and the second, but inside of the cotyledons. The ends of the beans, which by growing closely become deformed, do not have the embryo because its germinating properties would suffer in this place. The special arrangement of the seed in this case is to be admired. Nature has arranged things in such a way that the embryo does not suffer from the deformity caused by the seeds being pressed together. The root is thin, it has the form of a fibrous bundle, and in the majority of cases many small knots of different sizes containing bacteria which provide the plant with nitrogen.

COMPOSITION OF THE PLANT AND FRUIT.

The bean has great nourishing value, constituting one of the principal foods of the natives of Senegal. As is shown by analysis it is classified among the dried fruits which are essentially nutritive. Not only are the beans advantageously used, but the stems and leaves of the plant constitute a good forage; it is also used as a fertilizer, which when applied to the soil not only returns what has been taken from it but furnishes it with nitrogenized constituents, which have been manufactured by the plant—thanks to the special bacteria which take in nitrogen from the atmosphere.

The mean composition of the different parts of the peanut is as follows:

Peanuts raised on the agricultural experiment station at Río Verde.

Water	4.80
Ashes	2.70
Protein	26.19
Fibrous substances	3.81
Nitrate (in extract)	12.68
Fat	26.80
Organic matters	28.02

When the fruit is ripe.

Constituent.	Spanish peanut stems.	Georgia peanut stems.	Leaves.	Fruits.
Water	24.49	24.35	23.87	11.34
Ashes	8.75	9.70	9.04	2.97
Protein	9.13	7.45	8.09	6.32
Fibrous substances	18.28	26.21	24.16	19.00
Nitrates (in extract)	33.79	26.96	29.79	17.01
Fat	3.75	3.92	3.75	2.34
Organic matters	1.81	1.41	1.30	1.02

The following shows the immediate analysis of the bean, one made at the experiment station and the other by Mr. Moride:

	Experiment station.	Mr. Moride.
Water	4.80	2.70
Fat	26.80	35.44
Organic matters	65.80	59.86
Mineral matters or ashes	2.70	2.00
	100.10	100.00

It has been proven that the stems, even without leaves, are superior as a nourishing food to the stems and leaves of corn and many other forage plants, containing a large proportion of protein—being only a little inferior to red clover and alfalfa.

In regard to the fertilizing constituents which the peanut plant contains, the analyses show that its ashes contain large quantities of phosphoric acid and potash, as well as nitrogen, which elements are of most value as fertilizers. For this purpose the beans of the peanut are as rich as cotton seeds; the cake which is left after the oil has been extracted is very good for soils.

SEASON AND CLIMATE FOR PEANUT CULTURE.

The plant is better grown in hot climates than in the temperate zones, since in the former all of the beans of one and the same plant come out at the same time and take a shorter time for their development, being, of course, less susceptible to atmospheric changes, especially to drought or excessive rains. Excessive rains make the stem grow too high at the expense of the fruit.

It would be well for the plant to have, besides a hot temperature or climate, a relatively moist soil throughout its first period of growth and until the first blossoms appear, and then a gradually decreasing degree of moisture throughout the remaining periods. In temperate climates or when the buds come out in the cold season, the blossoms and buds make their appearance with a good deal of irregularity; those on the central part of the plant coming first, and their fruits ripen first; those on the branches near the center coming next; and lastly those at the greatest distance from the center where the blossoms will appear at the same time as the fruit on the central branches ripens. Its yield is greatest in dry but hot climates and in seasons without excessive moisture; otherwise, the leaves turn to a yellow color and dry up; and when the plant is laden with fruit the latter rots if unseasoned or sends forth suckers if ripe.

The quantity of oil in the bean seems to be less in proportion to the distance from the equator at which the plant is raised. If grown between 36° and 37½° north in the United States it possesses a more delicious taste and a greater quantity of oily substance; but it must be remembered that though it grows well in temperate zones frost is greatly injurious to the crop. The largest plantations of this legume are found in the Guianas, between 2° and 8° north latitude, and in South America where peanuts are exported to France for the purpose of extracting the oil; the exports from these countries amount to thousands of tons yearly. However, as already stated, this crop grows well in a temperate climate; that is, in sections free from frost for six months of the year with no excess of rain at a later period. If this latter requirement is fulfilled it is not an absolute necessity that heat to a high degree should prevail, for the crop can accomplish all periods of its growth and fructification in a relatively cool temperature.

SOILS SUITABLE FOR PEANUT CULTURE.

The plant grows luxuriously and fructifies well in a hot climate in soils where corn can be raised to advantage. A soil with a humus layer, somewhat loose with not much sand and a little lime, but fresh and rich, may be used, but in this respect the peanut plant is very exacting. The soil must be rich and well proportioned in its components of sand, clay, lime, and humus, namely:

	Per cent.
Quartz	25–70
Clay	20–30
Lime	5–10
Organic matter	5–10

A most important condition is that the soil should be easily permeable; nothing is more injurious to the peanut plant and its fruit than excessive moisture resulting from the stagnation of a quantity of water on the surface or in the underground layer of the soil. For this kind of crop the soil should be well drained; no matter whether this be on account of geological or hydrological conditions, we have recommended it to lowland owners both in Río Verde and Ciudad Fernández.

While it is true that a proper watering of the soil is an essential factor to its productive power, and the main condition for all good farming in peanut cultivation, irrigation however, must be used in moderate degrees, especially during the first period of growth and the period of blossoming. Land devoted to this crop should, therefore, be such as to afford easy and prompt draining off of the abundant rains that come at certain seasons of the year. It is for the above reason that clayey soils, which retain water for a long time are not considered the best; for while the kernels thus produced might be of a fairly good size they will be produced in smaller quantity; besides that they would take on a dark-brown olive color which causes their depreciation in the market. From the foregoing it must be

apparent that the existence in due proportion of sand, clay, and lime in the soil is greatly advantageous to this crop, provided the ground does not offer any obstacle to easy drainage and to a good airing of the earth.

Peanuts raised on a light, sandy, and rich alluvial soil, besides possessing a delicious taste, contain also a larger quantity of oil. As to the plant, it grows luxuriously when timely rains visit the plantation, or where the land can be easily irrigated. In Cuba, where the plant is raised almost exclusively by the descendants of the African negroes, on the small parcels of land which they call "conucos," the growers select for this crop clayey, calcareous, and somewhat loose soil with a good humus layer slightly colored by oxide of iron.

MANURES SUITABLE FOR PEANUT CULTURE.

The kind of manure which is the most valuable for plants in general is that which contains phosphoric acid, potassium, and nitrogen. There are some crops like the peanut which require lime in addition. The proportion in which each of these elements enters the fertilizer and the question as to whether each should or should not be supplied will depend on whether the soil contains it or not, and in what quantity and quality the plant can assimilate it at the proper time, also that these elements be supplied in the necessary quantity and proportion to the quantity of the whole of the fertilizer required by the plant; that is, in such a proportion as is necessary for the best development of the plant and its fruit.

There is no better manure for a particular kind of plant than that which contains the elements entering into the composition of the plant and its fruit. For this reason, the residue of the plant itself is one of the best fertilizers, especially if some mineral principles have been added which may restore those that have been taken out by the fruit.

When a plant is consumed by fire the organic principles and the water contained therein go into the atmosphere with the smoke, and all of the other mineral principles remain in the ashes. Both constitute the components of the plant and we must know all of the component elements of the plant, as well as those of the soil in which the plant is to be raised. The best way to know these elements is to analyze the plant and the soil, and after comparison of the experiments made on the same plant with different kinds of manures, we may then arrive at a knowledge of the other elements needed by the plant from the soil. Without this knowledge we can proceed only in a tentative manner, which by reason of the cost of the manure and the bad results which often attend experiments come to be very expensive and greatly reduce the profit which otherwise could be obtained. Hence the necessity of experiment farms where such manures may be studied and conclusions arrived at from the comparative cultures made with the various crops.

Although calcareous soil is not the best for peanut cultivation, a quantity of lime, however, should be, as already stated, one of the elements entering into the composition of the soil, above all in that of the lowlands of Río Verde and Ciudad Fernández, at the same time manures containing some phosphate should be used.

It being a matter of fact that the custom of manuring the soil has made little progress with us, no matter what kind of crop is planted on the land, it will sound strange to most cultivators to say that the soil devoted to this crop should be manured, as no experienced cultivator would select a poor soil to plant on; so we lay down as an *a priori* fact, that must be a rich land which experienced cultivators consider to be "good for peanut culture." This goes to corroborate what has been said in speaking of the best kind of soils for peanut culture; that is to say, that the plant grows best on rich loamy land, and thus we do not wonder that cultivators both at Río Verde and Ciudad Fernández look for this kind of land. As such cultivators acquire a better knowledge of the requirements of the plant and of the kind of manure most suitable therefor, they will then apply to their land, if it is somewhat sandy or poor, the manure which may be required to supply thereto such principles as it does not possess.

The fact should not be lost sight of that this plant draws nitrogen from the atmosphere, which is then transformed into manure, finally being absorbed and converted into nourishment. It is for us a saving of a manure which is most expensive.

The formula per hectare which follows was attended with excellent results for the few plants cultivated:

	Kilograms.
Nitrate of soda	70
Superphosphate of lime	600
Sulphate of potassium	60
Sulphate of iron	100

Before this manure is used all of it should be reduced to powder, that it may thus be free from lumps which take a long time to crumble, otherwise small spots of soil contain too much manure, which would be of little advantage to the plant growing thereon. In the manure, furthermore, the various components should be well mixed, that they may be as uniformily distributed as possible and that every filament in the root system on absorbing those elements necessary for its development may find in the soil the proportion of each element needed. It is not convenient to mix lime with the soil either before or after having manured with the superphosphate of lime within a space of twenty days; but, as it is well that soil containing a small proportion of lime should receive some in addition, the lime should be applied to the soil when it is still fallow or at the time of the first plowing, that the manure may

be well distributed at the time of the second plowing, which should not be more than twenty days after the previous one has been completed.

As nitrate of soda has an immediate effect, it is better not to mix it with the other components of the formula until later on, a few days before the planting is done.

As peanuts are not always planted on the most suitable soil, because as already stated such soil is seldom found, they might come to be successfully cultivated on a soil rich in organic matter but rather sour. In this case, it is not convenient to use the superphosphate of the formula, as the latter would be injurious to the culture, in that the sourness of the soil would thereby be increased, but rather use a simple phosphate or phosphate of lime in its place (the main phosphates are those drawn from the earth, such as apatite, phosphorite, phosphated sand, and nodules of amorphous phosphate), and in this manner the acidity of the soil will be modified and the manuring done at the same time, thus making the nitrification easier, which never takes place in sour soils, and renders the manure more soluble.

PREPARATION OF THE LAND.

The statement has already been made that the plant requires considerable nourishment and therefore well-prepared soil to obtain the best results from the crop.

Before beginning field work it is well to know in what season the planting should be done. For this purpose we must know the period of vegetation of the plant and care should be taken that the ripening of the fruit will not take place during a rainy season or one in which rains prevail in the smallest degree. This of course is only in reference to the plant's last period of vegetation in regard to the other periods of its growth, it is well to know that frosts are injurious to the plant, and that for this reason the planting should be done during a season in which frost is least to be expected.

Taking into account that the plant completes all of its periods of vegetation in six months, we must so arrange matters as to bring the cultivation under the season which is most favorably adapted to this crop. Taking into account, too, that the plant grows well only in well-aired and moderately moist soil, the first of these conditions will then be fulfilled where the soil is well plowed and cultivated to the depth to which the extremities of the roots of the plant will reach. This cultivation of the soil is done to the end that the soil may receive the air which carries oxygen along with it, serving to promote such reactions as are beneficial to the earth. It also gives life to microbes in the soil which when well plowed and well cultivated becomes more porous and takes in a greater amount of air. That we may better grasp the idea, and account for the phenomena, let us consider that a soil, to be rendered porous, should

contain from 50 to 60 parts per thousand of air and water; air entering to an amount of not less than 40 to 45 parts per thousand, and water in the remaining proportion of from 10 to 25 parts per thousand, which is the degree of moisture a soil should contain for a regular nitrification. Rain water being such an important element for every kind of crop, advantage will be taken of the rain for the soil; and we should endeavor not to waste it, but allow it to be imbibed by the earth to the highest possible degree; for in passing through it always leaves behind most of those elements which it carries in solution, the most important of which is ammonia, as in it is contained the nitrogen so favorable to cultivation. On the other hand, the very same water which is stored in and absorbed by the plowed layer of the soil is less easily evaporated in the case of a loose and well-plowed soil. A piece of land the humus of which has not been plowed suffers evaporation to an extent of 80 parts per thousand of the water which it contains, while on a loose and well-plowed piece of land the loss is only 14 per thousand of the water under the same conditions. It is also to be noted that if a heavy shower of rain comes on a fully prepared and planted piece of land there might remain on the surface a quantity of stagnant water which would cause the plants, especially as the peanut is of a delicate character, to rot or be drowned.

Before the first plowing of a soil where some previous crop has been gathered it will be well to use a disk harrow of twelve steel disks, arranged in two sets of six disks, each of which turns around on a horizontal axle, the latter may be set straight or inclined toward each other by means of levers in order to better cut the grass and crumble the lumps, leaving a level even surface when the first plowing takes place. This machine will also work as a mold-crumbler on nonclayey soil.

The first plowing which should follow the work of the disk harrow must be shallow, that is to say, from 12 to 30 centimeters in depth; whether it must be more or less, within these limits, the nature of the humus will determine. In the case of a sandy or poor soil, it would perhaps be more convenient not to turn it up or to mix it with the humus. In soil containing a thick arable layer and in rich soil, such as this plant requires, we must carry the depth up to 30 centimeters, that we may always keep a good amount of moisture in the soil so that the roots and fruit may find space for their development, grow better, and produce in greater quantity.

In working the field, it is well to consider its shape, the disposition desired, and to have the ridges between the furrows well apportioned, taking care that they be made as long as possible, to avoid the making of many turns by the work cattle, and the waste of time by unnecessarily increasing the labor, as is generally done by our field hands.

Time for field work.—It is of the utmost importance to know beforehand the field on which it is intended to raise a peanut crop, that the soil may be prepared and the work begun in time so that the earth

may reach that condition of absorption and assimilation which is necessary to furnish the required nourishment for the plant. It is always well to start the work of plowing some time before the planting, allowing for time to remedy any difficulties which might arise from the failure to have the work completed at the proper season, such as an excess of moisture or the prevalence of a drought, thus not allowing the lumps of earth turned up by the plow to molder off. The soil must be prepared immediately after the previous crop has been gathered, in December, or if possible earlier in November.

Stages and kind of work.—As has been already stated, the first work to be done to any soil intended for the cultivation of peanuts should be to render it porous and even, doing away with any furrows or other unevennesses remaining from the previous crop. For this purpose the disk harrow or "crumbler," to which reference has already been made, should be used.

As to how many times the work of plowing should be done, we need to be reminded that the custom of plowing only once should be discontinued, for in this way the soil is very poorly prepared. The results of this method are rendered manifest later in the scanty yield and the greater expense incurred by the larger amount of weeding which the grower has to do if the work on his plantation is well attended.

After the work with the disk harrow or "crumbler," the first plowing should be done with a disk, or other middle-sized plow, such, for instance, as No. 20 Avery, or Curimeo H. D., which go into the earth turning it up at least 12 centimeters deep. The soil should then be left undisturbed for twenty days before using the spiked harrow for breaking lumps and turning the soil into an even, porous, and well-aired condition. After this second plowing and a space of time has elapsed equal to that above-mentioned, a second harrowing should take place. Ten days later, another plowing should be done, if possible crossways to the previous one. The soil is now prepared to receive the seed, and it remains only to await favorable weather for planting. If the opportunity fails to present itself at an early date, and it rains in the meantime, it is very possible that some weeds will make their appearance; in this case it is necessary to use the spiked harrow again before the ground is furrowed for planting; otherwise, weeds will appear in quantities around the growing peanut plants checking their further growth and development.

SELECTION AND PREPARATION OF SEED.

The first condition to be complied with by an intelligent and enterprising cultivator is that of selecting his seed from plants which are known to have attained the largest development and have yielded the greatest amount of fruit. It is a general law applicable to every living thing that, as the parents are so are the children, and with this maxim

in mind, a good selection of seed comes as a necessary condition for the improvement of the product, and increasing the crop yield without great labor, difficulty, or expense.

As to the seed, the large-sized grains or beans should be selected, for the reason that the new plant, during its first period of growth, has no other food than the nutritive elements stored up in the seed, and on these the embryo of the peanut depends for its ultimate growth into a strong and highly productive plant. Every grain of seed which is not well ripened, or if shrunken or musty, or in case the thin membrane which envelopes it is not perfectly sound, should be rejected. The pods intended for seed should be long exposed to the sun in a dry place. Beside what has been said about selecting seed from plants which have attained the largest growth and have yielded the greatest number of pods, those strings should be selected which contain the greatest number of pods and the best shaped beans. One of the advantages of this latter selection is that the fruit ripens with greater regularity.

If the importance of fulfilling the above conditions has been well understood, we shall then endeavor to use as seed the fruit of those plants which ripened earliest in the season; for as a rule there are great advantages attached to this fact in every kind of crop, for example, the danger while the crop is exposed on the field from rain rotting the fruit if it is unseasoned, or causing germination if it is ripe.

Some people believe that the seed should be changed; that is to say, that the fruit once gathered from a particular field should not be used again for seed on the same field. They claim that by so doing the product becomes wild and degenerates. This, besides being questionable, will be found to increase the difficulty of acclimatation and adaptability of the seed to soils with different properties and different composition. What may have the greatest influence in causing this so-called degeneration of the product is the little care most growers use in selecting a seed which may possess all of the qualities hereinbefore enumerated. If any of such growers come to use the kind which fulfills the requirements of a good seed, they will then probably keep for themselves, and not for others, a kind of seed thus conditioned. I therefore feel inclined to recommend that as far as possible the fruit obtained on a particular plantation be used again as seed for the same plantation. This, of course, does not mean that if a better variety of the product be found to grow well on some different spot, the seed of the latter may not be used instead of the one which has been previously raised on the same spot.

In taking the bean out of the pod care should be taken not to break the membrane which envelops the bean, nor to break or crush the latter, which would result in damage to the embryo which is found at one end of the bean.

In order to hasten and secure better germination and proper nourishment of the plant, the seed should be put into some liquid which will not

only furnish moisture but also some nourishment to it. The soaking is done to bring out the nourishing substances which may aid the seed during the first period of its growth.

PLANTING.

As already stated, above all other conditions that of ripening the fruit during the dry season should be fulfilled. This season comes with us in Mexico wholly in October and we may have a good harvest if the planting was done six months before that date; that is, about the month of March or the earlier part of April. In different localities or countries the planting period comes at different seasons according to the time of the rainy season therein. In Cuba or Porto Rico the planting season is between April and May, in Cochin China and Spain in May and June, on the Guinea coast toward the end of June and throughout July, and in India in July and August.

From experiments made last year, the distance between plants which was attended with the best results was that of 80 centimeters from furrow to furrow, putting two grains together in the furrow at a distance of 60 centimeters. In the case of a rich soil, the furrows may be made 1 meter apart and the beans may be put two in a hill at the greatest distance of 80 centimeters; although a plant may fill a space of 1.20 meters or even more, it matters little whether the larger branches overlap each other, because the fruit itself grows at a very short distance from the stalk. With a small-sized plow the furrow is made. The seed is then dropped and another plow of equal size, which comes after the previous one, covers the seed with earth. After the planting has been done a harrow is used on the planted field to make it even and level, not only that harmful animals may find it more difficult to get at the seed, but that all subsequent work may be made easier.

VEGETATION AND CULTIVATION.

Six days after the peanuts have been planted the little leaves of the first shoots may be seen, this takes more or less time according to the climate. In Spain it takes from fifteen to twenty days, and the lower the mean temperature the longer it will take for the shoots to appear. At the end of one month the shoots are all put forth, and the plants have attained such a height as will render them capable of advantageously standing a first weeding. When the furrows have been made at a distance of 80 centimeters from each other the weeding can be done with a cultivator, taking care that the shovels do not touch the stalks of the plants. Immediately after the cultivator has been used laborers with hoes should go into the field clearing away all weeds and stirring up the earth around every plant.

A few days after the weeding, the first irrigating should take place, provided the soil is still pretty dry and the plants have not put forth

their branches. The work of irrigation should be continued in proportion as the dryness of the earth requires.

The first sterile blossoms will appear on the peanut plant one month after the shoots are put forth; two months later, keeping company with the growing branches, the fruit blossoms begin to appear at the leaf axils. The blossoms hang from a stalk which stretches out, reaches the ground and goes into the soil as an adventitious root. During this stage of growth of the plant it is well to have some slight irrigating work done to aid in the vegetation and the blossoming of the plant. This accounts for the fact that on light soil and soil deprived of water supply, the yield is small; this is on account of the withering of the plants. While blossoming is going on, it is well to cut off the ends of the principal branches that the sap may employ itself more fully in the shaping and development of the fruit and in imparting greater vigor to the blossoms and the beans.

If at this state the plantation is found to contain an excessive amount of weeds, a hand-to-hand weeding should take place, care being taken not to root up the branches and especially not to touch the stalks or filaments hanging down from the leaf axils.

DISEASES AND ENEMIES.

Sometimes the discovery is made of a plant beginning to assume a slight yellow color which, if not taken care of in time, will extend to the whole plantation. This comes to pass as a consequence of stagnant water, which by lack of proper drainage has remained in the field; it sometimes lies in the underground layer and does not appear on the surface of the soil. If the work of draining off the soil is taken up at once the evil may to a large extent be remedied, but if it is allowed to go on unchecked all the plants will rot, beginning, as stated before, by their first becoming yellow and then withering away altogether.

Among the enemies of this crop are to be counted rats, squirrels, monkeys, also quails and partridges. About the time germination begins in the seed the latter two scratch the earth and dig out the seed and destroy it. Quails are the more destructive of the two, for they are the more voracious and possess a greater scratching power. They not only begin their ravages at the first period of the growing seed but also at the early part of the fruiting season when they scratch all around the plants and eat the kernels or beans. For the destruction of these birds traps and poison-infected peanut grains are laid. This crop is one to which locusts can do but little harm.

HARVESTING AND DRYING.

When the leaves become yellow and dry we may conclude that the bean and pod have reached their full growth and are already ripe, the plant no longer affording nourishment thereto, the time for the harvest is at

hand. When there is no danger of rain, and there exists no pressing need for harvesting, the crop may be left on the field some weeks more before the appearance of the above symptoms, allowing the branches and the pods to dry up.

If the soil is loose, the first days may be devoted to carefully uprooting and heaping up the plants, which will be found to have some strings adhering to them that will drop off later. If the harvesting takes place in the early days after the ripening of the fruit there will be the advantage of a greater quantity of food going to the cattle, for the leaves do not all drop off and decay as in other crops, but keep a certain degree of freshness for a longer time, thus affording greater nourishment as a forage food. In order to clear the soil and at the same time to render the task of harvesting easier, the branches should be cut off from the roots and strings. This can best be done by grasping the branches with the left hand, lifting them up to a point when the trunk comes into view and then chopping them off with a cutlass. In this way the harvester walks in front piling up all of the branches to the left, carrying on his work in a space of from 2 to 3 yards wide. The branches are allowed to dry outside the field and later stored and used for forage.

When the soil is cleared, the peanuts may be dug with a plow, similar to that used for digging potatoes, which crumbs the earth and turns it up; men, women, and boys come behind and pick up those strings and pods brought to the surface by the plow and put them into baskets; they then separate the earth with both hands, to pick out such other pods as can be discovered until no more pods can be found in the hills. While the team is plowing the number of laborers should be apportioned by sections so that the work of every section will be finished within the space of time necessary for the plowman to come back and make a new furrow. This work is done by contract, quantities of 48 to 50 liters being delivered into the hands of the employer for 25 centavos.

The employer should have the drying place in readiness for the crop to be emptied and exposed to the sun. The drying place should be prepared on that portion of the field where the earlier harvesting took place. Such a tract or space as may be required for the operation should be leveled, then parallel strips of soil 1.20 or 1.30 meters wide marked out. Between every two of these strips a ditch of appropriate depth and width, enough for two persons to come abreast without hindering one another, is excavated. With the earth dug out of these ditches the strips are built up and made level, and on these the peanuts are spread out to dry in layers not exceeding 2 centimeters in thickness. In this way the peanuts are left exposed to the sun; but they should be shoveled over and over every day that they may be made uniformly dry; with this shoveling also whatever residue of earth the fruit retained will be shaken off.

MARKETING THE PRODUCT.

As the drying is going on, the quantity of the product may be ascertained by measuring it in hectoliters which weigh from 29 to 30 kilos each, after which they should be sacked up for market.

We have obtained as high as 78 hectoliters and 43 liters per hectare, or a total yield of 132 hectoliters of peanuts was harvested from 16,830 square meters of land; the weight was 29 kilos a hectoliter and the aggregate came to 3,828 kilos, or a yield of 2,274.5 kilos per hectare.

The seed used was as follows:

	Per cent.
Of only one grain in the pod	75
Of two grains	6½
Straw and earth	18½
	100

The seed harvested as follows:

	Per cent.
Of only one grain	71
Of two grains	7½
Straw and earth	21½
	100

One hectoliter weighing 29 kilos contains—

	Kilos.
Beans	22.76
Straw and earth	6.24

The amount of oily substance is 26.8 per cent, hence the oily substance in 1 hectoliter amounts to 6 kilos and 0.099 gram.

COST OF THE PRODUCT.

Preparing the soil	$16.20
6 hectoliters of seed (not very good)	32.04
Preparing the seed	3.65
Planting	20.42
First weeding	10.75
Second weeding	5.41
Irrigation work	3.45
Cutting off the branches	5.58
Harvesting	85.32
Rent on 16,830 sq. m. of land	27.22
Interest on investment for 6 months	9.45
Total	219.49

RECEIPTS FROM THE CROP.

132 hectoliters of peanuts, at $4.50 per hectoliter	$594.00
The forage estimated at	25.00
Total	619.00
Cost of production	219.49
Net profit	399.51

CONCLUSIONS.

As may be seen from the above data, peanuts are one of the best paying crops in our Republic; but it is difficult to find agricultural machinery adapted to harvesting them, unless the potato digger be considered such. It requires, too, a good deal of labor, a number of harvestmen, and the profit is good only where the wage standard is low. On the other hand, its culture can not be carried on over extensive fields or on a large scale because of the great number of hands required and the length of time the work of harvesting takes. Finally, the peremptory and pressing need of laborers for timely harvesting draws some bad characters into the fields, and unsettles the other work of the growers, for the latter have to put off in whole or in part all other kinds of work that they may devote the necessary time and attention to this crop.

THE CULTIVATION OF THEOBROMA CACAO OR COCOA.

(Continued.)

By A. Fauchère,

Assistant Inspector of Agriculture in Madagascar.

THE ESTABLISHMENT OF THE PLANTATION.

A plantation may be started in two ways—by planting the seeds directly or by using plants already started in a nursery. Each of these methods has its partisans and its adversaries. It seems to me that these differences in opinion are due to the different conditions under which the observations were made. Thus, Guérin, in his work, "Culture du Cacao á la Guadaloupe," utterly condemns the using of nursery stock, while the planters of Surinam and Madagascar usually plant trees that have been six or eight months in a nursery.

It is very evident that in the cacao lands in Guadaloupe, usually formed of decomposed volcanic rock, it would be impossible to raise the plants with balls of earth about their roots, and consequently the transplanting might be very harmful. This difficulty is not encountered when the soil is heavy. The young trees can be balled easily and do not suffer at all in transplanting. Furthermore, Guérin is quite wrong in saying that the taproot is the essential part of the cacao, and that the least injury to it results in the death of the tree. In Trinidad, when transplanting is done on the plantations, the ends of the taproots of the nursery trees are cut off, and they do not suffer in the least.

Studies made at the Ivoloina experiment station by my colleague, Mr. Deslandes, have proved that the cacao tree, like most other vegetable species, undergoes transplanting and shortening of the taproot without any bad results. Be that as it may, planting directly by seeds is the method most employed. In Surinam both methods are used, but this one is used exclusively in Trinidad, Venezuela, Ecuador, Brazil, and all the countries in which cacao planting is done on a large scale.

In Madagascar, so far, nursery trees are planted, but it is probable that seed planting will be done in the future, even though the results of attempts in this line at the Tamatave experiment station have not yet been satisfactory. In the valley of Mangoro, however, there is a small plantation that was started from seeds.

Planting by seed.—Planting the seed directly, or as it is often called, "at stake," has, like planting nursery stock, advantages and disadvantages. By sowing the seed at stake, time is saved and the plantation can be established more quickly. It is probably this fact that has led to the adoption of this method in all the countries where cacao culture is carried on to a large extent, and where manual labor is scarce. Less skill is required on the part of the laborers to sow the seeds directly in the spot in which the cacao trees are to remain than to take the young plants from the nursery and transplant them to a more or less distant place without breaking the cube of earth that protects their roots.

It is necessary to keep close watch just after the seeds are planted to defend the young trees against adventitious plants, which ordinarily grow with great rapidity. Insects may also cause damage by eating the plantlets at the time of germination.

Starting the plants in a nursery has the advantage, as was said above, of allowing the planter to make a careful selection, and plant only the well-formed and most vigorous specimens. Besides, while the trees are starting in the nursery—a period of from four to ten months and possibly longer—it is not necessary to cultivate the land. Trained workmen are required, however, for setting out the young plants. It is a slow process, and not the method usually employed in countries where cacao plantations are laid out on a large scale. But since both methods of installing a plantation are in use, I shall describe each one. Whichever method may be used, a nursery is indispensable, for in plantations started from the seed, replacing is always necessary.

Choice of seed.—If in the country where the plantation is to be started there are a number of well-known varieties of cacao, of which the needs are also known, the first thing to be done is to choose the variety that will furnish a product of high commercial value, and at the same time be best suited to the conditions in which it is placed. In Madagascar this question of choice does not arise as yet, for up to the present, except for the kinds introduced by the department of agriculture, which have not yet borne fruit, there is but a single variety in existence.

Choosing the seed-bearing trees is quite a different matter. These must be selected with extreme care; in fact it is the only way by which the yield can be improved. For this reason fruit for this purpose must never be taken from trees that are not prolific and healthy, and the fruits themselves must be well selected, the small or imperfect ones being thrown out. They must be picked as soon as they are thoroughly ripe, and as short a time as possible before planting.

If for any reason it is necessary to delay the sowing for some little time, or to send the seeds away, it is a good plan to open the fruit pods as soon as possible after picking, remove the seeds and place them in layers, alternately with layers of sand or mold, in a packing case if they are to be shipped, or in a pile if they are to be planted near where

they were picked. If the distance is not too great, it is better to keep the fruits intact until the seeds are placed in the ground; however, in this case it is necessary to use the seeds very soon, or fermentation will begin within the fruits and a number of seeds be rendered worthless.

When the planting is about to be done the fruits are broken and the seeds taken out. Imperfect seeds and those near the ends are rejected. In Madagascar it is reckoned that one fruit will provide not more than 25 seeds. From this it is easy to calculate in a general way the number of fruits needed, if four seeds are placed in each hole. The seeds being removed from the fruit the watery pulp that surrounds them is next washed off. The planters of Surinam and Trinidad do not do this as a rule. They roll the seeds in lime or ashes and then dip them in citron juice, to protect them from the bites of insects.

If the hole has not been made in which the cacao is to be planted, it will be necessary to clear away the brush to a radius of 2 to 2.5 meters about the picket marking the place. The top of the soil is then broken over a surface 50 to 60 centimeters in diameter, the stake marking the center. Then the seeds are placed in this space about 25 to 30 centimeters apart, at the corners of a triangle if three are planted, or at the corners of a square if four.

The seeds should be sown at a depth of from 2.5 to 3 centimeters, and the soil spread over them lightly. In Trinidad, where it is not the custom to dig holes, the method I have just described is followed, and the laborer plants usually "by the job," from 70 to 100 pickets, according to the condition of the brush. The clearing around these pickets and the breaking of the ground are of course included.

It is necessary to go over the ground frequently after the seeds are planted, to make sure that the weeds do not overrun the place. In Dutch Guiana the ground about the young cacaos is cleared thirteen or fourteen times a year. In Trinidad, where it is dryer, six or eight times seems to be sufficient. When the plants have attained a height of 20 to 25 centimeters, it is well to take out two or three, according to whether three or four seeds have been planted. The strongest plant is left, of course, and the others are used for replacing, where that is necessary. In some places the planters do not proceed in this manner. In Ecuador, for instance, it is the custom to leave two, three, four, and even more plants growing together. In the cacao plantations of Bahia, in Brazil, four plants are usually left.

The proprietor of large cacao plantations in Belmont, Bahia, explained to me that he believes this method is beneficial to the fruiting, because the four trunks tend, in growing, to move away from one another, and incline more and more as they become larger. The flowers which grow on the outer side of the trunks are thus sheltered from the rain, which would appear to make their development into fruit more certain. I give

this opinion for what it is worth, but must add that I have seen a great many cacaos growing alone and very erect, whose trunks bear fruit in an entirely satisfactory manner.

The method of allowing several plants to grow together is out of place in regularly laid out plantations, where, I believe, the trees should be as regular as possible in form. However, since this method is employed in regions where cacao culture extends over immense areas, and since I have not had an opportunity to study its advantages or disadvantages, I am not in a position to either condemn or advise it. It is probable, nevertheless, that it is a method that can be successfully applied only where the land is particularly fertile.

Time for sowing.—The time for sowing is necessarily determined by the times for the principal harvests, which occur in most of the countries twice a year. When the climate is very warm and the country situated near the equator, it is possible usually to plant at the time of one or the other harvest. When, on the contrary, the northern or southern limit of the zone for cacao culture is approached, it seems preferable to not sow until the time of the harvest nearest to the winter season, or, on the other hand, the harvest nearest the warm season. Observations made at the Ivoloina station have confirmed this opinion.

In Madagascar cacao is harvested first in June and July, and again in October and November. It is at this latter time that the planters usually plant the seeds, either at stake or in nurseries.

In June and July the temperature is too low, and the plants growing from seeds planted at this time develop slowly and are puny. In the event of planting the seeds in November it would seem best to plant the bananas in April or May. In Madagascar this time would probably be the best, for in Trinidad the planters prefer to set out the *Musa* during the cold season.

Sowing in the nursery.—If it is desired to establish a plantation with plants already started, a nursery is evidently needed, but even when started directly from the seed, it is necessary to have a small nursery containing plants for replacing those which are not healthy, or seeds which have not germinated.

Choice of the situation of the nursery.—If a large plantation is being established, one nursery will not be sufficient, but several should be located at regular distances over the plantation, to reduce as much as possible the distance that the plants will have to be transported, as well as the expense incurred in thus transporting them. In Trinidad, for example, a nursery is installed for every area of about 10 hectares.

The site upon which the nursery is to be placed should have as rich soil as possible; and it is equally necessary that the soil should be heavy enough to permit easy balling of the roots when the plants are moved. Shelter from the wind is a third indispensable condition.

In order to procure for the young cacaos the shade they demand, it is not desirable to plant them under the shade of larger trees whose roots usually monopolize the soil to too great an extent. I have seen certain Dutch planters in Surinam sow the cacao seeds even in the midst of the cacaos on a plantation. The plants that resulted were usually so puny and of such slow growth that this would seem to be a serious mistake.

Preparation of the soil.—The site having been chosen, it must be plowed to a depth of 25 or 30 centimeters, working in by this means the amount of manure, ashes, and mold that is considered desirable, and the stones and roots that are in the way can be removed.

After having thus plowed and leveled the surface, beds are laid out, about 1.2 meters square, separated by paths 50 centimeters wide, so that the coming and going necessary in weeding and watering the plants will be rendered as easy as possible. The beds are then leveled and the clods broken, after which six furrows 20 centimeters apart and 20 to 25 centimeters deep are made in each bed. The seeds, having been prepared as described under "Planting by seed," are placed at the bottom of these furrows at intervals of about 20 to 25 centimeters, care being taken to lay them with the flat side down. The surface of the bed is again leveled, covering the seeds lightly. Whether the surface is left bare, or is covered with a light layer of mold or sand to prevent it from baking, depends on the location. Sand has proven very satisfactory at the Ivoloina experiment station. In Trinidad, immediately after sowing, the ground is covered with banana leaves which are removed after germination begins.

Immediately after the sowing, if it has not been done before, shelters of some sort must be erected over the nursery. At the Tamatave station the shelters are about 1.8 meters above the ground. These provide the necessary shade without preventing the free circulation of air, and are high enough so that the laborers can work underneath.

Solid pickets about 2 meters long are planted in regular lines through the beds. Their tops are connected by sticks about 4 meters long which support a network of smaller sticks, stalks of rafia, or small palm leaves. Over the whole are firmly attached branches of heath, found commonly along the shore. They are fortunate in having at Ivoloina plants which furnish sufficient and well-regulated shade. These shelters may be accused of being too costly, but in an experiment station permanent frames are necessary, because the same place is used year after year for new crops, and so far nothing more practical has been found.

The planter who has no use for such durable shelters may follow the planters of Surinam who lay palm leaves over frames that are about 1.5 meters from the ground and supported on solid poles. In Dutch Guiana I have seen this method followed with very satisfactory results.

The leaves being simply laid over the frames without being attached in any way, the intensity of shade may be varied as it is found desirable.

Ordinarily in the plantations I have visited the young cacaos are not pricked, but this method has ben put into practice at the Ivoloina station, where it has proved a sucess, the remaining plants undergoing balling and transplanting more easily. Pricking does not appear to be indispensable, and it would seem that people who are desirous of planting large areas with nursery plants could well dispense with it.

In Trinidad the nurseries for replacing trees are made in a very different manner. If the plantation is not a new one, and the shade trees are mature, spots in which the soil is very compact and which are not covered with heavy brush are chosen under the shelter of these trees. The ground is cleared of weeds, but not plowed. Furrows 2 or 3 centimeters deep and 25 to 30 centimeters apart are made, and the seeds deposited in these furrows. The soil is then replaced and smoothed down, and banana leaves are laid above, which remain usually eight or ten days, or until the seeds begin to germinate, after which they are removed. Evidently this very simple method of establishing a nursery can be employed only where the cacao grows with extreme facility, and would be attended in such a place as Madagascar, for instance, with difficulty.

After the germination it is necessary to keep the soil clean by constant weeding. In the heavy lands of Surinam the surface of the beds is stirred up by means of little pointed sticks two or three times during the five or six months that the plants remain in the nurseries. This operation, which provides a free circulation of air in the soil, is a good one and should not be neglected. If the season is too dry it will be well to irrigate, or cover with straw, if need arises.

The length of time that the young cacaos remain in the nurseries varies according to the region. At Jagtlust (Surinam), where all the plantations are made by means of trees started in well-kept nurseries, setting out takes place four or five months after sowing. In Madagascar, from observations made at the Ivoloina experiment station, it is well to leave the plants in the nursery at least a year. In Trinidad the plants are set out eighteen months after sowing the seed. It is the opinion there that they should not be set out until they begin to form branches. I have seen trees nearly three years old transplanted with very good results.

The best time for setting out the young plants is certainly the warm and rainy season, but in countries where it rains practically the whole year it is possible to plant at any time, though it is preferable to wait until the vegetation takes a new start. In Tamatave setting out may be done from December to March, though December and January are the best months, so that the young plants may be well started and will not suffer so much during the cool season. The plants should be raised very carefully with as large balls of earth as possible. If they are transported

any great distance, it will be prudent and even necessary to cover the balls with banana leaves or green herbs to prevent breaking. On the contrary, if they are set out near the nursery it will suffice to place them carefully side by side in a case in which they can be carried to the location desired, and set in place at once by the plantation laborers.

It is not wise to take up a large number of nursery plants in advance, and those that are taken up should be protected from strong sunshine. If the planter is compelled to set out his trees during dry and sunny weather the process should be discontinued during the heat of the day. Neither in Dutch Guiana nor in Trinidad do they strip the leaves from the plants. But if the weather is at all dry they cut off part of the leaves in order to diminish evaporation.

In certain mountainous plantations in Trinidad I have seen the taproot cut off with a knife where it projected beyond the ball; and in other plantations situated on the lowlands, on the contrary, the taproot is preserved in its entirety and placed carefully in the hole that is made especially deep for this purpose. When I asked the manager of the plantation the reason for this he said that in the Arinao districts the cacaos were very much exposed to the winds, and the plants whose taproots had been broken off at the time of planting offered less resistance to the wind than those on which the taproots had been carefully preserved.

In setting out, the plants should be placed deep enough so that the top of the ball will be covered with soil to a depth of 3 or 4 centimeters. If a dry period follows the setting out it will be necessary to irrigate the plants whose balls have been broken. This precaution should not be neglected if regularity of the plantation is to be maintained from the outset. I know that planters in the great cacao-growing regions will smile if they read this, but I am writing it for the benefit of the planters in Madagascar where the climate is such as to make necessary precautions that would be superfluous elsewhere.

There is one method of preparing the plants that I have not mentioned, that which consists in sowing the seeds in baskets, pots, or better in bamboos of a certain diameter. It is everywhere employed in government establishments whose mission it is to furnish plants to individuals. The method must have its advantages since it is used, but it has also numerous disadvantages, which would prevent its regular use by those who plant upon a large scale.

AGRICULTURAL NOTES.

Weather conditions.—The drought is pretty general all over the Islands with more or less severity in some regions. Considerable damage is reported as having been done to crops in the towns of Santa Barbara in Pangasinan, Bangui in Ilocos Norte, Lobos and Sevilla in Bohol, Buhi in Ambos Camarines, Butuan in Agusan, and some districts of Batangas, Samar, Sorsogon, Capiz, Negros, Tayabas, Tarlac, and Cebu. There are, however, numerous exceptions to this condition and crops are reported as looking particularly fine in San Simon, Porak, San Luis, and Candaba in Pampanga, La Paz and Capas in Tarlac, Laoag in Ilocos Norte, also Cabadbaran in Agusan, Mambulao and Nabua in Ambos Camarines, Laua-an in Antique, Lipa in Batangas, Dimiao in Bohol, Maragondon in Cavite, San Francisco and Sibonga in Cebu, San Nicolas, San Fabian, Santa Maria, and Calasiao in Pangasinan, Binañgonan and Antipolo in Rizal, Sorsogon, Castilla, and Magallanes in Sorsogon, Dapa and Gigaquit in Surigao, and Tarlac, Bamban, and Pura in Tarlac.

After about the first of May rains were rather abundant in some provinces and in a few cases did a little damage to fields of rice, tobacco, and corn. The towns reporting this condition were Talisay in Ambos Camarines, Daet in Ilocos Sur, Malabon in Rizal, and Passi in Iloilo. Strong winds have also contributed to the damage done to crops still standing in the fields.

Enemies of agriculture.—Mice continue to do considerable damage in the rice fields, and in some districts of Albay, Samar, and La Laguna they have even attacked the crops of corn and sugar cane. Notwithstanding this, however, these crops seem to have a good prospect.

In Occidental Negros locusts and grasshoppers continue to do considerable damage to the fields of sugar cane. Such reports have been received from the towns of Manapla and Talisay. Swarms of locusts have also made their appearance in Bohol and done considerable damage to the crops in Sevilla, Sierra-Bullones, Loon, and Bilar. In spite of this fact, the harvests gathered in these places were not less than those of Kabancalan, San Carlos, and other towns of the province.

Harvests.—Rice from the second harvest has been collected in some towns, for example in Paombong and Hagonoy in Bulacan, Masantol in Tarlac, Gapan in Nueva Ecija, and some of these have reported large harvests. The crops of sugar cane, corn, hemp, and coconuts have also been reported as very satisfactory in the Provinces of Agusan, Ambos Camarines, Antique, Batangas, Bohol, Cavite, Cebu, Pangasinan, Rizal, Sorsogon, and Tarlac. The rice fields in La Laguna have been reported

as in excellent condition and it is expected that a large harvest will be gathered; in fact, much larger than for several years past. The price of hemp is very low, so low that our correspondent in Cabadbaran, Agusan, states that he offered all the hemp he had to anyone who cared to remove the fiber and no one appeared. Other cases like this have been mentioned in recent reports; the price continues so low that hemp growers are thoroughly discouraged.

Animals diseases.—Animal diseases continue in some districts, but comparatively few deaths have been reported. Those reported are from Patnongon and San Remigio in Antique, Porak in Pampanga, Santa Maria in Bulacan, Rosario in Batangas, and a few other towns. Attention has often been called to the fact that the existence of animal diseases in some sections is due to negligence of the authorities and the cattle owners. The municipal health officer in a town in Leyte asserted that certain animal diseases prevailed in his district but that it was not his business to stop them. It is hoped that all public officials as well as the owners of cattle will carefully study and follow the precautions which have been laid down by this Bureau to avoid the spreading of diseases which take away so many of the work animals of the farmers.

Correspondence.—A correspondent from Santa Cruz, La Laguna, makes inquiry regarding machinery for the husking of coconuts and a better means than that which is commonly used in the Philippines for drying the meat. It is understood that very satisfactory machinery for husking coconuts is being used in Ceylon and other coconut-growing countries, and that satisfactory ovens for drying copra are now in use; the editor will endeavor to obtain cuts or photos and descriptions of such machinery and apparatus as soon as possible.

Another correspondent from Baganga, Mindanao, writes encouragingly of conditions in that town. He states that it is situated in a section which is advantageous for the improvement of agriculture. Rain is reported as being very abundant and frequent from December to April; in fact, there is rarely a month in the year when there is not enough water for the favorable growth of any kind of crop.

The principal crop of the place is abaca which could be of first quality if the natives would only take some pains in stripping and cleaning. During the past year there has been gathered in all some 4,000 piculs and but for the lack of farm laborers much more could have been harvested. During the present year there has been quite a number of additions to the coconut, abaca, and rubber plantations. Four Americans have settled in Baganga with the intention of devoting their time to the improvement and development of agriculture. Baganga is said to be very free from contagious diseases and only a few cases of fever or grip are reported. Fortunately, the live-stock disease known as rinderpest is unknown. The roads are being gradually improved and the writer states that the town has good harbors, one situated on the north and the other on the east, so that steamers can come in at any time of the year.

CROPS PLANTED AND HARVESTED AND CONDITION OF SAME TAKEN FROM MONTHLY CROP REPORTS FOR THE MONTH OF MARCH, 1909.

[NOTE.—Attention is invited to the fact that rice should be understood as being in the unhulled state.]

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Area.	Quantity.	Unit.
Agusan (reports from 3 municipalities):		*Hectares.*	*Hectares.*		
Rice	Good	40	160	2,400	Cavans.
Abaca	do	11	15	400	Piculs.
Coconuts	do				
Tobacco	do				
Albay (reports from 13 municipalities):					
Rice	do	15	6,233	166,960	Cavans.
Abaca	do	70	5,590	11,351	Piculs.
Corn	do	178	48	460	Cavans.
Coconuts	do			691,200	Nuts.
Ambos Camarines (reports from 27 municipalities):					
Corn	do	111	29	229	Cavans.
Rice	do	14	4,053	60,047	Do.
Abaca	do	270	4,360	15,431	Piculs.
Coconuts	do			1,114,000	Nuts.
Antique (reports from 9 municipalities):					
Sugar cane	do	573	511	14,840	Piculs.
Coconuts	do			9,000	Nuts.
Tobacco	do				
Corn	do	61			
Bataan (reports from 7 municipalities):					
Rice	Fair	35	325	13,000	Cavans.
Sugar cane	Good	4			
Corn	Fair	3	4	10	Do.
Coconuts	do				
Batangas (reports from 12 municipalities):					
Sugar cane	Good	2,285	1,621	34,950	Piculs.
Corn	Fair	107	1,570	1,336	Cavans.
Abaca	do		42	97	Piculs.
Tobacco	do		20	40	Quintals.
Benguet (reports from 10 municipalities):					
Rice	do	44			
Sugar cane	do	315			
Corn	do	11			
Coffee	do	418			
Bohol (reports from 21 municipalities):					
Coconuts	Good			1,244,000	Nuts.
Corn	do	2,008	262	4,118	Cavans.
Rice	Fair		1,857	18,460	Do.
Abaca	do		77	289	Piculs.
Bulacan (reports from 15 municipalities):					
Sugar cane	Good	1,527	1,731	7,954	Do.
Tobacco	do		31	500	Quintals.
Corn	Fair	416	49	620	Cavans.
Rice	Excellent		17,080	694,770	Do.
Cagayan (reports from 13 municipalities):					
Rice	Good		570	10,550	Do.
Sugar cane	do	8			
Corn	do	383	45	950	Do.
Tobacco	do	328	10	100	Quintals.

Crops planted and harvested and condition of same taken from monthly crop reporters for the month of March, 1909—Continued.

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Area.	Quantity.	Unit.
Capiz (reports from 22 municipalities):		*Hectares.*	*Hectares.*		
Abaca	Fair	23	102	572	Piculs.
Coconuts	do			177,000	Nuts.
Corn	Good	77	73	440	Cavans.
Sugar cane	do	23	87	2,886	Piculs.
Cavite (reports from 8 municipalities):					
Rice	do	50	3,790	38,000	Cavans.
Sugar cane	do	248	190	4,975	Piculs.
Coconuts	do			24,000	Nuts.
Corn	do		13	124	Cavans.
Cebú (reports from 28 municipalities):					
Abaca	Fair	331	363	1,751	Piculs.
Coconuts	Good			398,000	Nuts.
Corn	Fair	3,528	18,346	196,501	Cavans.
Sugar cane	Good	152	418	10,338	Piculs.
Ilocos Norte (reports from 9 municipalities):					
Sugar cane	do	387	564	795	Do.
Tobacco	do	24	225	16,160	Quintals.
Corn	do	105	190	1,500	Cavans.
Ilocos Sur (reports from 20 municipalities):					
Sugar cane	do	424	582	4,692	Piculs.
Corn	do	175	753	6,086	Cavans.
Tobacco	do	105	139	1,364	Quintals.
Maguey	Fair	4	641	2,346	Piculs.
Iloilo (reports from 13 municipalities):					
Sugar cane	Good	103	335	7,550	Do.
Tobacco	do	15	124	250	Quintals.
Corn	do	115	105	515	Cavans.
Coconuts	Fair			34,000	Nuts.
Isabela (reports from 4 municipalities):					
Rice	do				
Tobacco	do	158	18	275	Quintals.
Corn	Good	35	35	796	Cavans.
La Laguna (reports from 13 municipalities):					
Coconuts	Fair			320,000	Nuts.
Rice	Good	1,167	440	6,872	Cavans.
Sugar cane	Fair	315	575	17,250	Piculs.
Abaca	do	8	624	630	Do.
La Union (reports from 9 municipalities):					
Sugar cane	Good	172	505	3,282	Do.
Tobacco	do	239	1,642	4,276	Quintals.
Coconuts	Fair			6,000	Nuts.
Corn	Good	60			
Lepanto-Bontoc (reports from 15 municipalities):					
Sugar cane	do	27	31	255	Piculs.
Tobacco	Fair	6	48	187	Quintals.
Corn	Good	3			
Rice	do	237	101	337	Cavans.
Leyte (reports from 14 municipalities):					
Abaca	do	198	5,374	25,526	Piculs.
Coconuts	do			1,384,000	Nuts.
Corn	do	300	782	8,050	Cavans.
Sugar cane	do	139	168	1,534	Piculs.
Mindoro (reports from 2 municipalities):					
Tobacco	do	1	1	5	Quintals.
Corn	do	13	12	100	Cavans.
Coffee	do	1	1		
Cocon uts	do			10,000	Nuts.
Misamis (reports from 6 municipalities):					
Coconuts	Fair			620,000	Do.
Corn	Good	103			
Abaca	do	3	120	1,045	Piculs.
Rice	Fair		100	846	Cavans.
Moro (reports from 4 municipalities):					
Coconuts	Good			214,000	Nuts.
Corn	Fair	21	9	270	Cavans.
Abaca	Good	3	82	859	Piculs.
Rice	Fair	7	36	720	Cavans.

Crops planted and harvested and condition of same taken from monthly crop reporters for the month of March, 1909—Continued.

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Area.	Quantity.	Unit.
Nueva Ecija (reports from 16 municipalities):		*Hectares.*	*Hectares.*		
Sugar cane	Good	14	94	1,410	Piculs.
Tobacco	Fair	5	92	572	Quintals.
Corn	Good	10	11	80	Cavans.
Nueva Vizcaya (reports from 3 municipalities):					
Sugar cane	do				
Tobacco	do				
Corn	do				
Coconuts	do				
Occidental Negros (reports from 10 municipalities):					
Sugar cane	do	2,000	20,960	117,360	Piculs.
Tobacco	do		101	1,005	Quintals.
Abaca	Fair		151	681	Piculs.
Corn	do	50	40	1,200	Cavans.
Oriental Negros (reports from 14 municipalities):					
Coconuts	Good			631,000	Nuts.
Tobacco	Fair		84	2,960	Quintals.
Corn	do	40	278	100,000	Cavans.
Sugar cane	do	90	128	7,000	Piculs.
Palawan (reports from 2 municipalities):					
Coconuts				300,000	Nuts.
Pampanga (reports from 8 municipalities):					
Rice	Good	1,000	40,083	96,950	Cavans.
Sugar cane	do	4,250	6,970	30,310	Piculs.
Corn	do	35	20	20	Cavans.
Pangasinan (reports from 28 municipalities):					
Coconuts	do			307,000	Nuts.
Tobacco	do	45	322	2,453	Quintals.
Sugar cane	do	1,103	599	3,743	Piculs.
Corn	do	421	147	1,457	Cavans.
Rizal (reports from 15 municipalities):					
Rice	do	168	500	1,200	Do.
Sugar cane	do	756	908	7,910	Piculs.
Corn	Fair	75	100	10,000	Cavans.
Coconuts	do				
Samar (reports from 24 municipalities):					
Rice	do	158	898	7,020	Do
Abaca	do	226	1,987	16,441	Piculs.
Coconuts	do			549,000	Nuts.
Sugar cane	Good	19	29	75	Piculs.
Sorsogon (reports from 14 municipalities):					
Corn	do	24	47	347	Cavans.
Coconuts	do			41,000	Nuts.
Rice	Fair	10	602	3,185	Cavans.
Abaca	Good	62	1,742	6,782	Piculs.
Surigao (reports from 5 municipalities):					
Rice	do		250	2,000	Cavans.
Abaca	Fair	50	600	5,013	Piculs.
Coconuts	Good			80,000	Nuts.
Corn	do	56	10	200	Cavans.
Tarlac (reports from 10 municipalities):					
Rice	do	412	5	80	Do.
Sugar cane	do	710	457	4,836	Piculs.
Corn	do	8	110	271	Cavans.
Tobacco	do	17	73	650	Quintals.
Tayabas (reports from 18 municipalities);					
Coconuts	Fair			2,893,000	Nuts.
Sugar cane	Good	3	31	229	Piculs.
Rice	do	2,150	100	1,347	Cavans.
Abaca	Fair	39	600	1,104	Piculs.
Zambales (reports from 6 municipalities):					
Coconuts	do			20,000	Nuts.
Sugar cane	do	20	5	115	Piculs.
Corn	do	35	2	8	Cavans.
Tobacco	Good	6		3	Quintals.

RANGE OF PRICES OF PHILIPPINE AGRICULTURAL PRODUCTS.

Highest and lowest prices of rice, abaca, copra, sugar, tobacco, and corn for the month of March, 1909.

Province.	Unhulled rice, per cavan.		Abaca, per picul.		Copra, per picul.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
Agusan	₱3.50	₱2.00	₱6.00	₱4.00	₱7.00	₱
Albay	3.75	2.30	6.00	4.80		
Ambos Camarines	4.00	2.00	11.80	8.75		
Antique	3.00	1.50	22.00	12.00		
Bataán	2.50	2.00				
Batangas	3.50	2.00	8.00	4.00		
Benguet	5.00	3.00	9.50	9.80		
Bohol	3.75	2.00	18.75	10.00		
Bulacan	2.80	2.00				
Cagayan	4.00	3.00				
Capiz	3.75	1.40	18.00	7.00	7.00	
Cavite	3.00	2.00	12.00	11.00	6.00	
Cebu	4.80	3.00	20.00	10.00	9.00	
Ilocos Norte	5.00	4.00				
Ilocos Sur	5.00	2.80				
Iloilo	4.50	2.00	18.00	12.00	8.00	6.00
Isabela	4.00	4.00				
La Laguna	3.80	2.40	13.00	6.50		
La Union	3.50	2.50				
Lepanto-Bontoc	4.00	3.00				
Leyte	5.00	2.50	11.00	4.80		
Mindoro	3.00	3.00	8.00	8.00		
Misamis	3.80	2.00	7.80	3.80		
Moro	3.50	2.00	11.00	6.00		
Nueva Ecija	2.00	1.25				
Nueva Vizcaya	1.50	1.25				
Occidental Negros	3.00	2.50	14.00	8.00		
Oriental Negros	5.00	3.80	14.00	5.80		
Palawan	3.00	3.00				
Pampanga	2.25	1.75				
Pangasinan	5.00	2.00			8.00	
Rizal	2.75	2.25	18.00	12.00		
Samar	5.00	2.50	14.00	8.00		
Sorsogon	3.25	2.50	12.00	5.50		
Surigao	3.12	3.00	27.50	6.50	7.25	
Tarlac	3.75	1.50				
Tayabas	5.00	2.50	12.00	3.00	6.75	
Zambales	4.00	1.50				

Highest and lowest prices of rice, abaca, copra, sugar, tobacco, and corn for the month of March, 1909—Continued.

Province.	Sugar, per picul.		Tobacco, per quintal.		Corn, per cavan.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
Agusan					₱2.25	₱2.25
Albay	₱7.00	₱6.00			3.00	1.50
Ambos Camarines	5.00	4.00			4.00	1.00
Antique	4.00	3.00	₱25.00	₱25.00	2.50	1.50
Bataan	4.00	4.00			3.00	3.00
Batangas	4.20	3.00	8.00	5.00	4.00	2.00
Benguet	6.00	3.00			4.00	3.50
Bohol	6.00	4.00	52.00	3.50	5.00	2.50
Bulacan	7.00	5.60	10.00	10.00	2.50	2.00
Cagayan	4.00	4.00	15.00	8.00	4.00	2.00
Capiz	7.00	6.00	8.00	4.00	5.00	1.12
Cavite	4.20	2.50			3.00	2.25
Cebu	5.00	2.00	25.00	4.00	4.50	2.50
Ilocos Norte	3.00	2.00	18.00	3.00	2.50	1.00
Ilocos Sur	7.00	2.00	60.00	3.50	5.00	2.00
Iloilo	6.00	3.50	40.00	5.00	4.00	2.50
Isabela			47.50	1.66	2.80	2.80
La Laguna	5.00	3.00			5.00	2.00
La Union	6.00	2.50	8.00	1.00		
Lepanto-Bontoc	6.00	2.00	5.50	3.00	4.20	4.20
Leyte	5.50	3.50	52.00	15.00	3.50	1.70
Mindoro			15.00	15.00	2.50	2.50
Misamis	4.00	4.00	25.00	9.00	3.50	2.50
Moro	5.25	5.25	7.00	7.00	3.50	2.00
Nueva Ecija	7.50	2.50	20.00	4.00	2.50	1.25
Nueva Vizcaya						
Occidental Negros	5.67	3.50	35.00	6.00	3.75	2.50
Oriental Negros	5.00	4.00	25.00	4.00	5.00	2.50
Palawan						
Pampanga	6.50	4.40	10.00	10.00	2.00	2.00
Pangasinan	6.50	2.50	30.00	2.00	5.00	1.50
Rizal	7.00	3.50			5.00	2.00
Samar	6.25	3.00	60.00	20.00	3.50	1.50
Sorsogon	2.50	2.50	14.00	12.00	1.50	1.25
Surigao					2.50	2.50
Tarlac	5.60	2.50	15.00	7.00	3.00	1.25
Tayabas	6.00	3.00	10.00	4.00	5.00	2.00
Zambales	5.00	2.00	12.00	12.00	5.00	2.00

PERIODICALS RECEIVED IN THE LIBRARY OF THE BUREAU OF AGRICULTURE.

ENGLISH.

GENERAL.

Agricultural Bulletin of the Straits and Federated Malay States, Singapore.
Agricultural Gazette, Sydney, New South Wales.
Journal of the Department of Agriculture of Victoria, Melbourne, Australia.
Journal of the Department of Agriculture of Western Australia, Perth.
The Queensland Agricultural Journal, Brisbane, Australia.
Tropical Agriculturist, Colombo, Ceylon.
Hawaiian Forester and Agriculturalist, Honolulu, Territory of Hawaii.
Memoirs of the Department of Agriculture, Calcutta, India.
Natal Agricultural Journal, Pietermaritzburg, Natal, South Africa.
Agricultural News, Bridgetown, Barbados.
West Indian Bulletin, Bridgetown, Barbados.
California Cultivador, Los Angeles, California.
The Rural California, Los Angeles, California.
Farmer and Fruit Grower, Jacksonville, Florida.
Louisiana Planter New Orleans, Louisiana.
Southern Cultivator, Atlanta, Georgia.
Progressive Farmer, Raleigh, North Carolina.
Farmer's Guide Huntington, Indiana.
Independent Farmer, Lincoln, Nebraska.
Kansas Farmer, Topeka, Kansas.
Farm Press, Chicago, Illinois.
The Feather, Washington, D. C.
The American Thresherman, Madison, Wisconsin.
Exporters and Importers Journal, Chicago, Illinois.
Oregon Agriculturist, Portland, Oregon.
Journal of Agriculture and Horticulture, Montreal, Canada.
Tropical Life, London, England.
Comercial America, Philadelphia, Pa.

REPORTS AND QUOTATIONS.

Crop Reporter, by the Secretary of Agriculture, Washington, D. C.
Federal Reporter, New York, N. Y.
Smith and Schipper's Monthly Report, New York, N. Y.
Hemp Market Report, Landauer & Company, London.
Ide and Christie's Monthly Circular, London.

LOCAL.

Official Gazette, Manila, P. I.
Philippine Journal of Science, Manila, P. I.
Far Eastern Review, Manila, P. I.
Weather Bureau Bulletins, Manila, P. I.
Philippine Agricultural Review.

SPANISH.

Boletin de la Cámara de Comercio Filipina, Manila, P. I.
Boletin Oficial de la Secretaría de Agricultura, Comercio y Trabajo, Havana, Cuba.
Boletin de Agricultura, San José, Costa Rica.
Hacendado Mexicano, El, Mexico, Mexico.
Agricultor Peruano, El, Lima, Peru.
Prácticas Modernas é Industrias Rurales, La Coruña, Spain.
Hacienda, La, Buffalo, New York.

OTHER LANGUAGES.

Bulletin de la Chambre de Commerce de Saigon, Saigon, Indo-China.
Boletim Economique, Hanoi-Haiphong, Indo-China.
L'Agronomie Tropicale, Brussels, Belgium.
Boletim de Agricultura, Sao Paolo, Brazil.
Tamil Journal of South India Agriculture, Madras, India.
Station Agronomique, Port Louis, Colony of Mauritius.
Journal D'Agriculture Tropicale, Paris.
Der Pflanzer, Kommunal-Druckerei, Tanga, Dutch, East Africa.

THE PUBLICATIONS OF THE BUREAU OF AGRICULTURE.

The following-named bulletins of the Bureau of Agriculture are available for distribution, and will be sent free of charge to any address upon application. Applicants are requested to state whether all publications of the Bureau are desired as issued, or only those specified. The name and address of the applicant should be plainly written and all communications should be addressed to the Director of Agriculture, Manila, Philippine Islands.

FARMERS' BULLETINS.

No. 4. Preliminary Report on Commercial Fibers of the Philippines. (Spanish.)
No. 6. Experimental Work with Fungous Diseases of Grasshoppers. (Spanish.)
No. 9. A few Suggestions on the Cultivation of Cotton. (Spanish.)
No. 11. The Jute Industry. (Spanish.)
No. 12. Abacá. (Manila Hemp.) (English.)
No. 13. The Cultivation of Maguey in the Philippine Islands. (English and Spanish.)
No. 14. The Cultivation of Sesamum in the Philippine Islands. (Spanish.)
No. 15. Tobacco Growing in the Philippines. (English and Spanish.)

PRESS BULLETINS.

No. 6. The Tamarind. (English.)
No. 8. Maguey; Propagating Abacá from Seed; etc. (English.)
No. 9. Agricultural Districts; Control of Rinderpest; etc. (English.)
No. 11. Seed Distribution; Need of Diversified Farming; etc. (English and Spanish.)

POPULAR BULLETINS.

No. 1. Maguey. (English, Spanish, Visayan, Cebuano.)
No. 2. Kapok. (English, Spanish, Tagalog, Visayan, Ilocano, Cebuano.)

PLATE I.—NELLORE BULL AT TRINIDAD STOCK FARM.

Age, 3½ years; weight, 566.98 kilos; height, 164 centimeters; length, 230 centimeters; heart girth, 196 centimeters; flank girth, 207 centimeters.

THE PHILIPPINE

Agricultural Review

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EDITORIAL.

LOCUSTS.

In this number of the REVIEW we are presenting a short article on the threatened locust pest which has been reported from more than one-half of the agricultural provinces in the Islands. The importance of giving this matter immediate attention can hardly be overemphasized, as is well understood by those who have seen the results of the work of swarms

of locusts in various parts of the Islands in times past. Unless this matter receives prompt attention by the farmers as well as by municipal and provincial officials there is sure to be a famine in some of these provinces during the coming year as a result of the destruction of the crops by locusts.

FARMERS' QUESTION PAGE.

The editors of the REVIEW desire to bring the Bureau of Agriculture as closely in touch with the farmers as possible, and to this end the Editor has decided to give space in the REVIEW for a farmers' question page on which replies to questions from farmers will be taken up and answered as promptly as possible. It is the desire of the Director that communications intended for this department of the REVIEW be addressed to the Editor of THE PHILIPPINE AGRICULTURAL REVIEW, and that they be confined as closely as possible to practical problems in agriculture—such questions as when answered will immediately benefit the individual farmer.

THE NELLORE CATTLE.

Two of the most interesting articles in this number of the REVIEW, particularly to the farmers of Negros, Bulacan, Pampanga, and other sections where cattle are used as draft animals, are those on the Nellore cattle by Dr. Frank C. Gearhart, acting chief veterinarian of the Bureau of Agriculture, and the one on the Ongole Cattle Show and Arni Agri-Horticultural Exhibition from the Madras Mail of April 6, 1909. The Nellore cattle which were recently imported from India have been inspected and admired by many people and, in case they adapt themselves to the conditions of this climate, there is every reason to believe that this is a step in the way of a revolution in the cattle-raising business of the Philippines. It would seem that a breed of cattle better suited to the needs of Philippine agriculturists will be available in the near future.

AGRICULTURAL EXHIBITIONS.

This number of the REVIEW contains the announcements, or accounts, of five different agricultural exhibitions which have taken place or, with one exception, will take place in the near future. In fact this may be regarded as the first exposition number of THE PHILIPPINE AGRICULTURAL REVIEW.

The account of the Annual Poultry Show in Hawaii is only a suggestion as to what could and ought to be done along these lines in the Philippine Islands. Hawaii, as compared with the Philippines, imports only a small amount of eggs and poultry, $16,511 as against $253,661 for the year 1908. Such an exposition in the Philippines would give Philip-

pine poultry growers an idea of the comparative value of the stock they are now raising, and it would indicate the lines along which progress can most easily be made in order to make the industry meet the demands of the Philippine market.

The Ongole cattle show held in the Madras Presidency in India was one of the most important exhibitions of the kind that has been held for many years. It is well known that the Hindoos worship cattle, and in Madras they have given special attention to breeding. As an illustration of what can be done by giving attention to the marked characteristics of different kinds of stock, and by careful selection in breeding, we have the Nellore cattle. When considering the actual needs of the Philippine farmer, no one can question the superiority of these animals over the animals commonly raised and used in the Islands.

The agri-horticultural show which will be held in Penang in August is just the kind of agricultural exposition which should be held in every agricultural province of the Philippines as soon as possible. In Queensland there are at present over 200 agricultural societies and organizations, 25 of which have already announced the dates for holding their expositions this year. In New South Wales there are over 40 such organizations, all of which will hold fairs this year; Victoria and Western Australia have over 100 such societies.

The fiber congress, which is for the purpose of discussing the fiber-growing industry in tropical countries, and for the exhibition of the best kinds of machinery for stripping and preparing fibers for market, is one which should be of more than usual interest to Philippine agriculturists, more especially the maguey and hemp growers of the Islands. Matters of interest are bound to be brought out in the discussions which will take place at Sourabaya in October of next year, and the privilege of seeing in operation the various kinds of fiber-stripping machinery, which will be exhibited on that occasion, will be of inestimable value to Philippine fiber growers, and they should see to it that a sufficient number of delegates are sent to this congress, not only in behalf of the associations of fiber growers and agriculturists but by the Government, for promoting one of the first industries of the country.

The announcement of the tropical exhibition, which takes place this month in Olympia, for the purpose of promoting travel and commerce with the tropics, should be of interest to everyone who is anxious to promote agriculture, trade, and commerce in the Philippines. It is presumed that practically everyone knows of the enormous sums of money which are spent each year in Japan by travelers and tourists, simply because the Japanese have made the most of the natural conditions and advantages of their country, and have been keen enough to make them known to the world, particularly to those who travel. To those who are thoroughly familiar with Japan and the Philippines it seems that as a place of interest to tourists and travelers the Philippines have

fully as many points of scenic and historic interest as do the islands of the Japanese empire. It is largely a question of our improving the environment and the facilities for reaching such places as the Lake, Taal Volcano, Pagsanjan, Baguio, Mayon, the southern islands and the Moro country.

While the editors of the REVIEW are fully in sympathy with all work for the education of the people and the progress of the country, and most emphatically believe that these lines of work should be emphasized as best they can, at the same time in all of our work, in so far as we are not able to proceed by actual demonstrations, we are severely handicapped by the lack of information, of touch with the outside world, of scientific progress along agricultural and other lines, on the part of the Filipinos. However simple we make our instructions and however important or significant may be the reason for our efforts, yet the average citizen or farmer fails to appreciate them or to see them from our point of view. We are of the opinion that the only way to get immediate results in the line of agricultural work and the development of the country is by actual demonstrations. We doubt the possibility of making the Filipino farmer realize the importance of raising better poultry, better hogs, better cattle, better horses, and better plant products on the farm, in any other way than by actually bringing him into competition with his fellow-farmers and showing him how poor the present products of his farm are as compared with those of other Filipino farmers who give some attention to the science of agriculture. Only when he sees the actual results of better attention to these subjects, as they are shown at a fair or exhibition, will he be ready and anxious to know how such results are to be obtained and to profit by the larger financial returns which come to the intelligent farmer. In fact, we believe that all that we can do in other ways will meet with little response from the average agriculturist in this country, as compared with the effect of bringing him into competition and face to face with actual results in a manner which affects his personal pride, as well as his financial interests. In this manner only do we believe he can be made to respond to and realize the significance and importance of the work which we are urging him to undertake.

The coming Carnival will afford an opportunity for various kinds of agricultural and industrial exhibitions, and it is understood that the directors of the Carnival are anxious to have the provinces and the people in the country take as prominent a part as they can, and make the Carnival an Insular agricultural exposition or fair, which it eventually should be. In connection with the next Carnival it is hoped that a poultry show, a cattle exhibition, a horse show, a sugar-growers' congress, a tobacco-growers' congress, a fiber congress, and an agri-horticultural show will be prominent features.

THE TROPICAL EXHIBITION,[1] OLYMPIA, JULY, 1909.

ANNOUNCEMENT.

To promote travel and commerce with the tropics.
President, Sir Gilbert Parker, D. C. L., M. P.
Chairman, Col. W. J. Bosworth.
Manager, A. Staines Manders.
Exhibition offices, 75 Chancery Lane (Holborn), London, W. C.
Representatives desired in every country. Correspondence invited.

The travel and tropical exhibition is making rapid progress. The British Cotton Growing Association states that it will require a floor space of over 40 square feet, besides wall space for photographs, etc.; Messrs. Elders and Fyffes, Limited, will exhibit bananas.

[1] Tropical Life: Vol. V, No. 3, March, 1909.

THE AGRI-HORTICULTURAL SHOW IN PENANG, AUGUST, 1909.[1]

ANNOUNCEMENT.

At a meeting of the central committee held in the governor's office, Government Buildings, Penang, on the 5th instant, it was decided to hold the next agri-horticultural show on the 9th, 10th, and 11th of August. These dates were considered as most suitable by reason of the fact that the fruit season is then about at its best; further, there are two public holidays in Penang at that time, thus enabling the sub-committees to have more time for the receiving and dispatching of exhibits. Circulars in the various vernacular languages are being prepared, and will be issued this week, stating the objects for which the exhibition is held. It is hoped that all intending exhibitors will begin at once to prepare their exhibits.

[1] Agricultural Bulletin of the Straits and Federated Malay States, Vol. VIII, No. 4, April, 1909.

THE FIBER CONGRESS AT SOURABAYA, OCTOBER, 1910.

ANNOUNCEMENT.

With a view to promoting the cultivation of fiber-producing plants, the Nederlandsch-Indisch Landbouw Syndicaat has decided to hold, at Sourabaya, Java, Netherlands East India, in October, 1910, a congress combined with an exhibition of fiber-producing plants, of the fibers produced therefrom, and of the machinery used in the preparation of the same.

During the congress the cultivation and preparation of the raw fiber, both mechanically and manually, will be discussed. The extraction, preparation for market, and packing of the fiber will, as far as possible, be demonstrated. Various prizes, medals, diplomas, and money prizes will be offered for machinery. Prizes will be awarded to the exhibitors of machines working for a sufficient time during the congress that are considered worthy of an award by a committee of impartial experts. The expenses of the congress and exhibition will be defrayed by the syndicate, which is enabled to do so by a liberal grant from the Netherlands Indian Government and substantial contributions from commercial houses and private persons.

In conjunction with the director of agriculture a committee has been formed to prepare and carry out the scheme, while a number of gentlemen in Holland have been requested to form a subcommittee there. A prominent place in the programme will be given to the consideration of the cultivation and preparation of those fibers most suitable for culture on a large scale in the tropics. Special attention will be given to the following, viz:

(1) Agave fiber, the cultivation of which is spreading so largely and which is specially adapted to dry tropical countries.

(2) Manila hemp, also a fibrous plant fit for cultivation on a large scale, which produces a profitable crop in well-watered districts of tropical countries.

(3) Jute and jute substitutes. Of importance in all tropical countries, seeing that a large part of the packing material necessary for other produce is made therefrom. As the cultivation of agave fibers and Manila hemp and the like can be remunerative only when carried on with efficient machinery for the treatment of the fiber on a large scale,

and when suitable hand machines are available for the use of the small producer, special attention will be paid to the testing of machines sent to the congress for exhibition, as regards both the extraction and treatment of the fiber. In addition to the above named, other fibers may be dealt with more or less fully according to the interest shown at the congress.

A detailed programme will shortly be published dealing with the project in all its particulars and enumerating the prizes to be awarded. This preliminary notice will serve to make known to all those who are interested in the cultivation of fibers in tropical countries the opportunity shortly to be offered of exchanging ideas on the subject, and will give timely notice to manufacturers of machinery of the opportunity to be given for displaying the merits of their respective machines.

LOCUSTS.

By Wm. D. Hobart, *Division of Statistics.*

Up to the time of going to press, the Bureau of Agriculture has received information from eleven provinces that swarms of locusts have been observed, and in some of these provinces considerable damage has already been done to growing crops. The provinces afflicted are Bataan, Batangas, Bulacan, Capiz (including the subprovince of Romblon), Cavite, Cebu, Iloilo, Occidental Negros, Oriental Negros, Pampanga, and Rizal.

Upon learning that a locust plague was imminent prompt steps were taken to check it so far as possible. In the weekly crop report of May 26 special stress was laid upon the necessity of the coöperation of the agriculturists along the lines provided for in Act No. 817, of August 3, 1903, which was passed at a time when crops generally were suffering from this pest. Again, in the crop report of June 2, prompt action was urged and Act No. 133, section 1 (6), was quoted, under which, when locusts appear, provincial boards are authorized to vote funds for the employment of a temporary force of employees and lay down the regulations under which they shall combat them.

The Executive Bureau has sent out a circular letter urging provincial boards in the provinces affected to institute a vigorous campaign against locusts, and to stop further spread of this scourge if possible.

This was followed by a circular letter of the Bureau of Agriculture to provincial boards in all of the provinces, giving them information as to the habits of locusts and modern methods of fighting them, as furnished by the Bureau of Science. The circular was largely a reproduction of an article appearing in the Agricultural Review for May, 1908, and it is suggested that all interested in this subject read this article again at the present time. The Bureau of Science in a recent communication to this Bureau strongly urges trying a measure suggested by them for killing the full-grown locusts, which is the building of huge bonfires at night to attract them, when they can be killed in large numbers.

When the eggs have been laid many of them can be destroyed by plowing up the land; but when that is not possible, destroying the young during the month before their wings are full grown is comparatively

much easier than later when they can fly. Killing them by covering the ground with dry grass when they are hatching out and setting fire to it has proved very effective and may be supplemented by catching, with nets, those who escape, while they are still weak.

The destruction of insects by every known means at the present time is of such vital importance to crops of all kinds that the farmers, who are directly interested, with the aid of provincial and municipal authorities, are urged to exert their utmost powers in a campaign which should be short if all will take part in it.

PLATE II.—THREE NELLORE COWS AT TRINIDAD STOCK FARM.

Average age, 2½ years; average weight, 362.87 kilos; average height, 153 centimeters; average length, 210 centimeters; average heart girth, 178 centimeters; average flank girth, 182 centimeters.

THE NELLORE CATTLE.

By Frank C. Gearhart, D. V. M., *Acting Chief Veterinarian.*

During the month just past the division of animal industry received a very fine shipment of Nellore cattle. The photographs of some of them are here given. They were selected with great care at the annual Ongole cattle show in the district of Nellore, Madras Presidency, by Lieut. Col. Gunn, M. R. C. V. S., superintendent of the civil veterinary department, Madras, who made the purchase aided by Mr. N. B. Stewart, American consul at Madras. None but strictly first-class cattle were selected, several of them winning prizes at the fair. The original purchases consisted of 10 young cows, many of them pregnant, and 2 medium-aged bulls. One fine female calf was born en route and another soon after the dam's arrival in Manila, so that the herd now numbers 14 head and the indications are that this number will be augmented.

One bull, four cows, and a calf were disembarked at Iloilo and taken to the comparatively rich pastures on the Government farm at La Carlota, Negros. Here they will experience about the same climatic conditions as affect the greater part of the labor animals of the Archipelago. The young bulls will be broken at proper age and their efficiency as draft animals under prevailing conditions will be tested before they are disposed of for breeding purposes. Because of their large size and their ability to cover ground at a rapid pace it is believed that they will be of special value to the sugar growers of Negros. The ordinary bullock, principally because of his lack of weight, has never been popular in this section of the country as a draft animal, and the carabao used so extensively does not fulfill the needs for many reasons, the chief ones being his very slow gait and nonresistance to disease.

The remaining portion of the herd with the exception of the young calf and its mother, which will be sent later, have been taken to the Trinidad stock farm in Benguet. In addition to the one object of demonstrating their worth as transportation animals on the mountain trails and roads, it is the desire of the Bureau to observe them under mountain conditions, and if they prove a success, to interest the large number of live-stock growers in the provinces and endeavor to influence them to use these cattle in improving their native breeding stock. The

native cattle now being produced in comparatively large numbers in the provinces have little to commend them, except the one important feature of hardiness. They are in the main small and wild, and are therefore of but little value except for their hides and meat.

The mountain provinces have many natural advantages over the larger part of the remaining portion of the country conducive to successful cattle raising, such as a constant supply of pure water, a superior grass, and, most important of all, they are isolated to a great extent from the sources of dangerous infectious diseases. The supply is sure to exceed the local demand and it is very important that the surplus sent out be of a satisfactory working type and disposition, for it is work cattle and not beef animals that the lower provinces are so much in need of at the present time. The indications are that the demand will steadily increase during coming years.

If after a short trial these cattle evidence a disposition to adapt themselves to the climate, feed, and needs of this country, and thus fulfill the reasonable and well-founded expectations of their promoters, others will be secured.

The natural habitat of the Nellore breed is hot and dry and the question of their thriving in a country where the rainfall is as great as it is in these Islands has been raised. Though time and experience only can decide this question definitely, the writer and many others are of the opinion that they will adjust themselves to the differences in climatic conditions in a very satisfactory manner.

Though in many respects European breeds of cattle may be superior to those indigenous to the Orient, they have not as yet proven to be of any value in Asia and the adjoining islands under the natural range conditions. A careful study of the many and varied conditions affecting the welfare of cattle to be found in Asia and the Philippines leads one to believe that the Asiatic breeds will thrive in a satisfactory manner under commonplace conditions in this country. This conclusion has been supported by very satisfactory results obtained here from breeding Chinese and Indo-Chinese cattle. The cattle of India, though raised under much the same conditions as regards climate and feed, are, because of selection for a great number of years, much superior to the cattle found in the other two countries named.

More than 800 Nellore cattle have previously been shipped to the hot regions of Brazil and are reported as doing well especially when crossed with native breeds. Two years ago 200 Mysore cattle were sent to Java and have proved such a success that the Dutch government now has agents in Ongole buying the Nellore breed which is much finer and more expensive than that of the State of Mysore.

In no country of the world, with the possible exception of the Jersey and Guernsey islands, has any one breed of cattle been found to be the best breed for all sections of the country. This assumption holds

true to a less extent for all other animals. Therefore it is the policy of this Bureau to bring to this country other cattle than those coming from the Nellore district. The Nellore cattle will likely do well in most parts of this country, but it is reasonable to suppose that they will do better in some sections than in others. Among the many breeds or varieties of cattle in India there are undoubtedly others that in certain sections of this country will surpass those originating in the Nellore district. The Nellore breed has been selected for the initial herd because it possesses many superior points in conformation and labor-performing qualities over the cattle from other districts of India.

THE ONGOLE CATTLE SHOW AND THE ARNI AGRI-HORTICULTURAL EXHIBITION.[1]

The Ongole cattle show which closed on Saturday was, on the whole, a great success; though the number of exhibits was not as large as at some previous shows, the quality was pronounced to be the finest that has been seen at these shows for the past five years. This show is the outcome of the remarkable agricultural movement set on foot a few years ago largely through the enthusiasm of the Hon. Mr. A. E. Castle Stuart, who has played the part of an agricultural missionary with great success. His intimate knowledge of the ryot population and of the cattle breeders of the district, his power of persuasion, and his friendly and familiar talks with the ryots in their own language, have made him *persona grata* with them, and all of those influences have combined to give the movement a strong impetus. Though essentially a local one, this show has rightly come to be regarded as a provincial institution and has been deservedly helped and encouraged financially and otherwise by the department of agriculture. As a mart for the exhibition of the best animals of the celebrated Ongole breed, it has proved of great service to cattle breeders. It has attracted almost world-wide attention, and during the last five years sales to the extent of several hundred thousand rupees have taken place at the show, the purchase in a large number of cases having been made for foreign governments. In fact, so great has been the demand for the best Ongole cattle that already people in the locality are beginning to be seriously agitated over the threatened depletion of their best stock of animals, a matter which was prominently brought to notice this year by the organizers, and dwelt upon at some length by Mr. Castle Stuart in his speech. Those who have followed the development of the show from its inauguration have observed a striking improvement in the breed, a result which is mainly traceable to the influence of the shows and the opportunities they have afforded cattle breeders for studying the points of excellence in the best specimens of the breed and of perpetuating them by careful selective breeding. The Ongole cattle show has come to stay, and there should be a great future before it, if only cattle breeders and ryots will make the best of the opportunities afforded them to improve their prospects.

[1] From the Madras Mail of April 6, 1909.

In his opening address, Mr. Castle Stuart gave some good advice to cattle breeders and ryots and quoted statistics which ought to open their eyes to the large possibilities in store for them. He tried to correct some of the common misapprehensions on the part of the people in regard to the provision of pasturage for cattle, and emphasized the need for hand-feeding and stall-feeding of the animals if the breed is not to deteriorate by indiscriminate and promiscuous herding of cattle. He urged the cattle breeders of the district to pay particular attention to the cultivation of the very best fodder crops, more especially cholam, guinea grass, and lucernes. Finally he impressed upon them the vital necessity of maintaining the breed true to type, to increase their numbers and to improve their quality by careful selection and good management. This distribution of prizes on Saturday was characterized by much enthusiasm and was the occasion for well-deserved congratulations all round. Lieut. Col. W. D. Gunn made an interesting speech to the cattle breeders, telling them to remember that they could get good prices only on condition that they bred good animals; to keep as many of their best cows as possible in order to keep the monopoly in their own hands; to breed from only the best and soundest stock, and to maintain the show as an annual function—points which were reënforced in another telling speech by Mr. Castle Stuart. It must be a matter of great satisfaction to the organizers of the show and a source of encouragement to the cattle breeders to know that 484 out of about 600 animals exhibited have been sold, the bulk of the purchases being made for the Java government, the Government of the Philippines, Jamaica, Brazil, and a Bombay firm for export. The organizers of the show are to be congratulated on the success which has attended their efforts.

ARNI AGRI-HORTICULTURAL EXHIBITION.

Another equally valuable and interesting show from the point of view of the agricultural improvement and rural economics was the agri-horticultural exhibition organized by the young Jaghirdar of Arni and opened on Saturday by the Hon. Mr. Murray Hammick. Considerable enterprise was shown by the Jaghirdar and the honorary scretary in bringing together a varied, interesting and large collection of agricultural products from all parts of the country. Mr. Hammick delivered a thoughtful speech in which he dwelt on the part which the landed aristocracy of this country can and ought to play in its agricultural and general development. There is indeed great scope for useful and philanthropic work by zemindars if they will only rise to their duty and to a sense of their responsibility. They are the natural leaders of their community, which has a right to look to them for light and leading. In the Madras Presidency there are many ancient zemindaries covering large tracts of country and possessing a numerous tenantry. The zemindars' responsibility is very great and important. and they can not

be too zealous in the discharge of their numerous duties. Great is their opportunity now, when the country is on the eve of important reforms in which they will play a prominent and important part as hereditary leaders and representatives of the people, to whom, as his excellency the viceroy remarked in his speech at Lahore, the government must look for information and guidance. The words of advice which Mr. Hammick offered to the zemindars were also apt and timely, and it is sincerily to be hoped that they will be laid to heart.

ADDITIONAL NOTES ON RICE CULTURE.

By Silverio Apostol, *Agricultural Assistant.*

METHODS OF SEEDING.

In addition to the report on rice cultivation in Zambales and Pangasinan published in the May number of the Review, the writer desires to mention a third method of seeding, or preparing the "semillero," practiced by the rice growers of a great portion of the Province of Nueva Ecija. This is done where the water supply is under control. The ground, as usual, is plowed and harrowed three or four times, or until it is well pulverized for good germination. The seed is put in a rice sack and then placed in water and left there to soak. After three or four hours the seed is removed from the water and hung up wet for about twenty-four hours, or until at least about 50 per cent of the grains have sprouted, when it is sown broadcast on strips or lots about 8 or 9 feet in width. The soil at the time of sowing must be well saturated and kept in that state until the young plants have acquired sufficient height and vigor to stand more water. Some farmers keep their seed beds under water all the time, while others cut off the water supply for a day or so every once in a while and thus expose the growing plants and the soil to the free action of the sunshine and air.

Of the three methods of seeding—namely, (1) the one described in the foregoing, (2) that by drilling the seed, or the Ilocano method, and (3) that by sowing it without sprouting on a drier bed than that used for sprouted seed—I have been informed by almost everyone who is familiar with them that the Ilocano method of drilling is the surest, especially where there is any danger from lack of rain or the water supply is not under control. The seed being equal, the Ilocano method generally gives a germination of not less than 90 per cent, while either of the other two methods gives only 75 or 80 per cent or less. On the other hand, the seed stools less with the Ilocano method of seeding. There is no noticeable difference, however, in the behavior of the plants transplanted from seedlings produced by these three different methods of seeding.

In Tarlac Province, especially in the municipalities of Capas, Tarlac, and Concepcion, dry-season rice growing is more or less practiced. Of course only those lands with artificial irrigation can be utilized for this purpose, and there is only a small area in each town that has such

requirements. There are a number of varieties adapted to the dry season. They are collectively called "palakaya" or "tag-araw" rice; "inita," an awnless variety, is the one mostly grown. The planting is done during the early part of February and the crop is harvested in May. The process of growing or cultivation is very simple: After the land is cleared of the regular crop—about the middle of January—the field is flooded, drained, and then the rice stubble is plowed under. Some plow the ground a second time, then it is harrowed and the seed is sown broadcast while the soil is still saturated. I can not give the exact rate of sowing because I could find no one who was able to furnish such data. From what I have seen, however, I reckon it to be about 1½ *cavanes* of seed to a *balita* of land, or about 375 liters (10 bushels) per hectare. After the seed has germinated and rooted, and is therefore free from the danger of floating or being washed away, should there be any danger of the young plants suffering from drought, it may be watered again and drained. The water has to be kept on after the plants have produced three or four leaves and cut off again after they have fully headed. It is said that only from 6 to 10 "cavanes" (450 to 750 liters), generally about 7, of crop are obtained from dry-season rice.

In Zambales Province the highland rice growers, like the American Indians, I am told, practice boiling the rice before hulling it, after which it is cooked and used for food. This is done when the rice has been freshly cut and thrashed and sometimes is still green, or when there is not enough sunshine to properly dry the paddy. The process of boiling is rather one of steaming than actually boiling. It is believed, and I know it is a fact, that by so doing the rice kernel is made tougher and thus is better able to stand the pressure of hulling.

POPULAR AGRICULTURAL INSTRUCTION IN THE UNITED STATES.

By E. A. Coddington, *Assistant Editor.*

AGRICULTURAL EXHIBIT TRAINS.

For some years past it has been a custom in several of the Western States for the leading railroad companies to build and equip railroad cars, and for the State officials or promotion organizations to fill them with exhibits of the agricultural products from the different parts of a State to demonstrate the natural richness of the soils and the country for the purpose of inducing settlers and others to purchase lands in the State and develop its agricultural resources. These cars, with attendants, lecturers, and demonstrators, sometimes three or four of them together, having been thoroughly advertised in the sections to be visited, have been sent over all the principal railroad lines into the North and South Central, the Eastern, and the New England States, where they were sidetracked in the principal cities and exhibited their agricultural productions, while lectures were given and printed matter distributed with the purpose of giving the people in the more thickly settled sections of the United States an adequate idea of the wonderful agricultural possibilities in such States as Washington, Idaho, Oregon, Utah, and California.

In some cases boats have been equipped with similar exhibits and sent from port to port where they have remained several days at a time exhibiting the products of the particular State or section which they represent; in like manner lectures and descriptions of the country and its possibilities were given, and much printed and illustrated matter distributed. These methods of popular instruction or advertising have been carried on for years by various Western States and have given a wonderful stimulus to the development of agriculture west of the Mississippi River and along the Pacific coast.

AGRICULTURAL AND HORTICULTURAL DEMONSTRATION TRAINS.

In the March number of The Rural Californian we find the following notice of a special agricultural and horticultural demonstration train:

> The Southern Pacific Railway Company will operate a special agricultural and horticultural demonstration train. The University of California and the State Horticultural Commission, through scientific and practical men, will have

delivered, at stopping points, lectures on methods to be pursued in increasing the value of agriculture, horticulture, live-stock raising, dairying, poultry raising, and kindred industries. The equipment of the train will include two cars containing valuable and comprehensive exhibits to be used in illustrating and demonstrating the points brought forth in the discussions. There will also be a coach for use as a lecture room in towns where no hall is available. Every person in the sections visited, who is interested, is earnestly invited to attend these meetings. Where the place of meeting is elsewhere than in the train it will be made known locally through the railway agents, newspapers, and other sources of information.

The schedule and speakers are as follows: Dr. Benjamin Ide Wheeler, president of the University of California; Prof. E. J. Wickson, director of the experiment station; Prof. W. T. Clark, superintendent of the department of university extension in agriculture; Prof. G. W. Shaw, of the cereal department; Prof. R. H. Loughridge, soils and fertilizers; Prof. E. W. Major, department of animal industry; Prof. W. B. Herms, medical entomology; Prof. H. M. Quayle, entomology; Dr. C. M. Haring, veterinary department; Prof. E. B. Babcock, department of plant pathology; Mrs. M. E. Sherman, viticulture, table grapes; Prof. R. E. Smith, southern California pathological laboratory, Whittier; H. J. Ramsey and T. F. Hunt, citrus experiment station, Riverside; J. B. Neff, Anaheim, conductor of farmers' institutes in southern California; J. W. Jefferey, State horticultural commissioner; E. M. Ehrhorn, deputy horticultural commissioner; E. K. Carnes, superintendent of State insectary; Frederick Maskey, fumigation expert.

According to the proposed schedule, the train will leave Los Angeles in the morning of March 10. The places to be visited and the hours at which meetings are to be held in those places will be as follows:

"*Wednesday, March 10:* Pasadena, 9.30 to 11.30 a. m.; San Marino, 1 to 2 p. m.; Arcadia, 2.10 to 3.10 p. m.; Monrovia, 3.30 to 4.20 p. m.; Duarte, 4.30 to 5.30 p. m., also 7.30 to 9.30 p. m.

Thursday, March 11: San Gabriel, 9 to 11 a. m.; Monte, 11.15 a. m. to 12.15 p. m., also 1.15 to 2.15 p. m.; London, 3 to 5 p. m., also 7.30 to 9.30 p. m.

FARMERS' INSTITUTE TRAINS.

More recently the large railroad companies have coöperated with the Department of Agriculture of the United States or the bureaus of agriculture in the different States and equipped cars while the National or one of the State departments of agriculture furnishes speakers and lecturers. These cars are sent through the sections which are specially devoted to some staple crop, such as corn, wheat, cotton, etc., and lectures are given at each station on the best methods of growing corn, wheat, or cotton—the subject being the staple crop of the section of country which each car visits.

In accordance with this plan each car proceeds on a well-advertised schedule, drawn by the trains of the railroad company, to the stations where it has been advertised and the people have already congregated. The people enter the car, are seated, and a lecture is given on the particular crop in which they are most interested; after the lecture is over the car is drawn by the railroad company to the next station, where the people are in waiting, and another lecture is given on the same subject. This is continued from station to station throughout the sections in which a particular crop is raised, and in this manner much

valuable information is disseminated and a great deal of interest and enthusiasm for more intelligent agricultural work is aroused.

This plan is usually carried out on the initiative of the great railroad companies for the increased profit that will come to them from the larger crops raised by the farmers along their lines and delivered to them for transportation. Usually the government of the State or the United States furnishes the literature and the necessary equipment or apparatus for the lectures and demonstrations, and the railroad company furnishes the car or cars and carries out the scheme according to their own convenience for the development of the country.

In the same number of The Rural Californian above mentioned we find the following notice of the Southern Pacific farmers' institute train:

In a communication to The California Cultivator, Prof. Warren T. Clark says in discussing the trips of the demonstration train now being run over the State: "The next trip, which will begin in the latter part of February, will cover a part of the southern portion of the State. The route taken will probably be as follows: Bakersfield, Lancaster, Newhall, Los Angeles, San Gabriel, Monte, Covina, San Dimas, Lordsburg, Pomona, Lemon, Chino, Ontario, Bloomington, Colton, San Bernardino, Redlands, Crafton, Highgrove, Riverside, Redlands Junction, Beaumont, Banning, Indio, Coachella, Thermal, Mecca, Browley, Imperial, El Cantro, Heber, Calexico.

"During all or a part of the time that the train is in southern California the following University representatives will accompany it: President Benj. Ide Wheeler; Prof. W. T. Clark, superintendent of university extension in agriculture; Mr. J. B. Neff of Anaheim, conductor of farmers' institutes for southern California; Prof. F. T. Boiletti, viticulture; Mr. R. E. Mansell, cover crops and truck gardening; Prof. C. M. Major, animal industry, and Prof. Ralph E. Smith, plant pathology. Other experts will be called on as the occasion may demand.

This plan has seemed so novel to Europeans that The London Illustrated News for February 6, 1909, devoted a full-page illustration to the subject, entitling it "A schoolhouse on wheels, or learning farming aboard a train." The following comment was made: "America's encouragement of agriculture: a lecture on scientific farming in a railroad carriage. Without some scientific knowledge the farmer of to-day can not expect to succeed. America, realizing this, is teaching those engaged in agricultural pursuits how they should follow their business. The first of several trains that are to be used as moving schoolhouses is now on the road. Lectures on farming are given and stoppages are made wherever it is thought necessary. Each talk lasts forty-five minutes and it is a fact worthy of notice that many women attend the courses."

NATIONAL ORGANIZATIONS.

The National Department of Agriculture.—Beside the above means of popular agricultural instruction in the United States there are many ways more common to the people at large in which agricultural knowledge is disseminated. Perhaps the most prominent of these different means of disseminating agricultural knowledge is through the work of the National Department of Agriculture, which includes the Weather Bureau,

Bureaus of Animal Industry, Plant Industry, Chemistry, Soils, Entomology, Biological Survey, Statistics, The Forest Service, Division of Publications, the Office of Experiment Stations, and the Office of Public Roads, and has through its various officials and employees, such as the directors of different kinds of agricultural work, experts, and lecturers, accomplished as much or more toward the progress of agriculture and the general improvement of the country than any other Bureau of the National Government. Mr. Roosevelt stated that he believed that the Department of Agriculture benefited the country more for the money invested than any other Department of the Government.

Demonstration farms.—A most interesting feature of the educational work organized by the United States Department of Agriculture is that which is carried on by means of the demonstration farms of the Department. These farms were started with the object of showing, by numerous practical examples over a large area, the advantages of improved methods of agriculture. The depredations of the Mexican cotton boll weevil, which threatened the entire destruction of the cotton crop in many districts, was one of the chief reasons which led to the starting of this work.

The term "demonstration farm" is used to designate a portion of land on a farm that is worked strictly according to instructions. This is visited by an agent once a month to see that these instructions are carried out, and to give further advice if necessary. The farmers who coöperate and give reports on results also agree to cultivate their crops according to instructions, but are not visited regularly by the agents.

State departments of agriculture.—In coöperation with the National Department of Agriculture are the State departments or boards of agriculture, which form an important part of the government of each State. Twenty-one of the States and Territories have commissioners of agriculture and twenty-nine of them have State boards of agriculture. In all of the States and Territories except Alaska, Hawaii, and Porto Rico advantage is taken of the provisions of the Acts of Congress of July 2, 1862, and August 30, 1890, providing for agricultural instruction. The number of these institutions is sixty-five. In twenty-one States the agricultural colleges are departments of the State universities. The total number of persons engaged in agricultural education and research at the land-grant colleges and experiment stations in 1907 was 6,243 and the number of students 66,193. The agricultural experiment stations are, with very few exceptions, departments of the agricultural colleges.

National commissions and organizations.—Some of the movements on the part of the National Government for the development of agriculture and the improvement of country life have been the meeting of the governors of all of the States in Washington for a conference with the President regarding matters which were of most concern for the development and promotion of the best interests of the people of the different States, the calling of the National Conservation Commission, and the

appointment of the Commission on Country Life by President Roosevelt. Beside these newly inaugurated movements there are many permanent organizations such as the Association of American Agricultural Colleges and Experiments Stations, American Association of Farmers' Institute Workers, American National Live Stock Association, National Wool Growers' Association, National Dairy Association, American Breeders'. Association, forestry associations, schools of forestry, National Bee Keepers' Association, Farmers' National Congress, Patrons of Husbandry, and horticultural societies.

The Graduate School of Agriculture.—Other gatherings which were of no little importance and should not be overlooked were the sessions of the Graduate School of Agriculture. The third session was held at Ithaca and Geneva, N. Y., July 6 to 31, 1908. Dr. A. C. True, Director of the Agricultural Experiment Stations, United States Department of Agriculture, served as dean and Prof. G. N. Lauman, of the College of Agriculture of Cornell University, acted as registrar. This school was organized through the standing committee on graduate study of the Association of American Agricultural Colleges and Experiment Stations. During the sessions of the Graduate School meetings of the following organizations were held: American Society of Agronomy, Association of Dairy Instructors and Investigators, International Conference of Poultry Instructors and Investigators. It is estimated that at least 350 persons attended the sessions of the school. At the closing meeting Dr. True said: "Probably never before has there been gathered together for so extended a period so large and enthusiastic a body of scientific men interested in agriculture."

Farmers' unions.—Beside the above-mentioned meetings and conferences, which were of national importance, there are local, State, and national gatherings of the Patrons of Husbandry and other farmers' unions, which are organized in almost every State and, in fact, in almost every township, if not every town, in every county and State in the Union. The Patrons of Husbandry, or the Grange, while it claims to be a secret society, is organized solely for the promotion of the interests of the farmer and the improvement of the conditions which surround country life.

The farm press.—A very important factor in the line of agricultural instruction and coöperation, one which has only been started in the Philippine Islands, is the work of the agricultural press. In almost every State there are papers devoted to the particular agricultural interests of the various sections of the State, which materially assist the farmers who read them, and furnish a medium of communication between farmers of different sections, enabling them to better coöperate with one another and assist each other in the different lines of agricutural work which they are carrying on.

LOCAL ORGANIZATIONS.

Farmers' institutes.—Another means of popular agricultural instruction, which is voluntary on the part of the people in almost every large section or community, is the Farmers' Institute, which in most cases closely coöperates with the agricultural college and experiment stations of the State. These organizations of farmers hold meetings at least once or twice yearly, at which farmers from the different parts of a section discuss questions regarding the best methods of raising the crops in which they are interested and the best means for promoting their general interests at home and abroad. Through coöperation with the State department of agriculture or the State agricultural college these meetings are usually furnished with lecturers or instructors on those lines of agriculture in which the farmers of the particular section are most interested. On the other hand, through the work of the State agricultural colleges or experiment stations in many States, the farmers who have organized themselves into institutes, associations, or unions are induced to visit the State agricultural college and experiment station at least once during the year, at which time the lines of work which are being carried on at the college or station are explained to the farmers and such questions as are of most importance are dealt with in general discussions or conferences which the farmers are invited to attend and participate in. Such excursions tend to bring the farmers into much closer sympathy and communication with the agricultural college and the experiment stations of their State. In many cases there is very close sympathy and coöperation on the part of the farmers with the colleges and experiment stations and many questions of importance to the farmers are immediately referred to the college or experiment station where they are taken up, investigated, and answered to the satisfaction of the individual farmer.

State and county fairs.—Another source of agricultural information and instruction, which should not be neglected, is what is popularly known as State and county fairs. At these fairs, which are often held in the smaller sections of the States, the products of the farms from the country around are exhibited and various money prizes, awards, medals, premiums, etc., are given for excellence or superiority of the different products. In some States almost every county has a county fair and later on, in most States, a State fair and agricultural exposition is held. Before these fairs the farmers vie with one another endeavoring to raise the best products on their farms, and as a consequence of their desire to excel there is a natural demand for further information regarding the best means of raising the different crops and of breeding the best farm animals. In this way many of them are brought into communication with the State colleges and experiment stations which are organized for the promotion of the best interests of the farmers and the advancement of life in the country.

THE FARMERS' SCHOOLS.

The work of the common school.—Another source of popular agricultural instruction and one which has for a long time been neglected is the work of the schools for the farmers' children. Mr. John E. Bell, writing for The Outlook of April 10 last, says:

> A little preliminary awakening is taking place along this line, but as a rule the farmers' teacher is not fitted by education, understanding, or inclination to teach the farmers' school. The farmer should be taught his business in his school; but what is the standing of agriculture in our country schools? Why, the average teacher of the farmer's school, it might be said, knows nothing about the nature of farming, cares nothing, dislikes the farm, and is teaching as a step toward getting away from the farm. When the teacher of the farmer's boy wishes to incite him to study and effort, wishes to create an ambition, he tells the boy that if he studies hard and learns well he may some day be a clerk in a store, or a bookkeeper, and tells the girl that she may become a stenographer and typewriter.

The following table is compiled from the United States Census for 1900 and the Census of the Philippine Islands for 1903.

The total number of persons engaged in gainful occupations in the United States is placed at 29,286,000, or 36.3 per cent, in the Philippine Islands 3,037,880, or 43.5 per cent, classified as follows:

	United States.		Philippine Islands (per cent).
	Number.	Per cent.	
Agricultural pursuits	10,438,000	35.7	41.3
Manufacturing and mechanical pursuits	7,113,000	24.4	31.6
Domestic and personal service	5,691,000	19.2	18.87
Trade and transportation	4,778,000	16.4	7.5
Professional service	1,264,000	4.3	0.8

It has been recognized for some years past that the course of study for the common schools is made up solely for the purpose of preparing the children in the schools for advanced training in high schools, academies, and colleges. Our schoolbooks have been prepared on the science basis and the literary basis, and with scientific or academic objects in view, to such an extent that we have had science readers and stepping-stones to literature as the substance of reading matter for the boys and girls in the country schools for more than a decade. While the courses of study for practically all of our schools in the United States and the Philippine Islands have been made upon the basis of preparing for advanced scientific, literary, or classical education, it is a recognized fact that not to exceed 10 per cent of the boys and girls are ever able to take advantage of such advanced training or education, and the remaining 90 per cent, who must follow agricultural, manufacturing, and mechanical pursuits, trade and transportation, domestic or personal service, receive no consideration whatever in the course of study or the work of the common schools. In short, the whole purpose and plan

of our educational system is solely for the benefit of the well-to-do 10 per cent of the population who may enjoy the opportunity of advanced training in high schools, academies, colleges, and possibly univerisites.

It would seem that the teachers of our common schools, more particularly the country schools, should be prepared to instruct the boys and girls in those subjects and along those lines of learning which they need for their future life work, instead of training them along literary, scientific, or classical lines, as is the case at present both here and in the United States.

It would seem that, in the country schools at least, the farmers' daughters should be taught—without books—something of home economy, of the value of different foods and the best methods of preparing them, the elements of sewing, in short a better knowledge of domestic science and art than they obtain at home. It would seem that in the country school the teacher should be qualified to train—without books—the boys and girls of the country in the fundamentals of such subjects as the following:

(1) The nature and value of different soils.
(2) The selection of seed.
(3) Methods of seed testing.
(4) The planting of trees.
(5) The practice and principles of pruning.
(6) The practice and principles of grafting.
(7) How to start home fruit gardens.
(8) The treatment of the common plants, fruits, and grains for the prevention of common diseases.
(9) The nature of common animal diseases and how to treat them.
(10) The elements of drainage.
(11) The elements of irrigation.
(12) The making of plans for school gardens.
(13) Plans for the improvement and beautifying of home and school grounds. A better knowledge of these things by the boys and girls of the country means a higher standard of living and life for the country and the nation, and a higher working efficiency of the individual citizen.

Along this line many popular books have been produced in the United States, among the foremost are "Among Country Schools" by O. J. Kern, several books by Prof. L. H. Bailey, of the Agricultural College for Cornell University, the reports of the United States Commissioner of Education and the National Educational Association. These reports contain accounts of the school garden movement and the move for agricultural education in country schools in Germany, Prussia, France, Holland, Sweden, and Russia.

SCHOOL MOVEMENTS.

While the work of our country schools has been solely for those who could afford to go to high schools, colleges, and universities, those who choose the farms and the country for their life work—those who, according to Mr. Roosevelt, stand for what is fundamentally best and most needed in our American life—are left to get what they can from the schools, and statistics show that 90 per cent of them drop out, never take this advanced training, or finish a course. As Mr. Bell has said the farm and the farmer is despised in the farmer's school by his teacher, and eventually by his own children. Recently there has been a tendency on the part of some educators to consider this neglected 90 per cent, the boys and girls of the farmer and working man, who pays for the school. In some States the courses of study have been changed so as to train for the business of the farm and the country, to enhance the value of country life, to beautify and make farm homes attractive.

Farmer boys' experiment clubs.—One of the more important movements in the schools for arousing an interest in the business of the farm and a desire for agricultural knowledge is the farmer boys' experiment clubs, which in some cases number as many as 500 boys between 9 and 21 years of age. In these clubs the boys test the vitality of different seeds, make investigations with reference to diseases of plants and animals raised on the farm, experiment with sugar beets and green corn, and in some cases corn-growing contests have been held.

Girls' home culture clubs.—Side by side with the boys' experiment clubs, home culture clubs are being organized for girls, in which the girls have general cooking contests, bread-making contests, and needlework contests. Through these clubs almost unbounded interest has been aroused in the work of the home and the farm, the everyday life of the boys and girls is made much more attractive, and country life takes on a new meaning. Beside the advantage of turning the minds of our young men and women to the improvement of country life, there is not that discontent which comes from educating them to ideals they can never realize and leaving them untrained and unprepared for the service they must perform.

Educational excursions.—In addition to the organization and the contests of the boys' experiment clubs and the girls' home culture clubs, many educational excursions are planned and made by them to State agricultural colleges, State universities, or State capitals, and thus a knowledge is obtained at first hand of the direction and the results of the different lines of government work, of commercial and social conditions outside of the little community in which they usually live.

HAWAII'S ANNUAL POULTRY EXHIBITION.[1]

The annual exhibition of the Hawaiian Poultry Association took place in the National Guard rifle gallery, Honolulu, on Thursday, January 14, 15, and 16 and two succeeding days. The collection of birds was a very satisfactory one and maintained the high standard of quality of former exhibitions. In addition to the poultry display, agricultural exhibitions were made by the Hawaii experiment station and by the board of agriculture and forestry, although it is to be regretted that it was found impracticable to include the general agricultural competitive display which has formed a part of some former exhibitions.

POULTRY EXHIBIT.

As heretofore the Plymouth Rocks were very conspicuous, not only in numbers but in quality. Dr. C. M. Cooke's display in this class was particularly effective. White Plymouth Rocks and Orpingtons showed an increase of popularity, while an entirely new bird was seen in the Rhode Island Whites exhibited by Messrs. J. Johnson and J. Andrade. The pens of Leghorns, Wyandottes, and Rhode Island Reds also contained many handsome birds. Among the prize winners in the domestic class, the following names were of frequent occurrence: Mrs. S. I. Shaw, Messrs. J. J. Greene, C. M. Cooke, jr., J. F. G. Stokes, L. C. Ables, R. C. Brown, J. Cullen, F. Santos, and Dr. C. B. High.

More specimens of the ornamental breeds were in evidence than in former years: Frizzles, Silkeys, and Black Polish being represented with creditable birds.

Among the pigeons the most handsome birds were probably the Jacobins and Pouters, and although the display was not large, the general quality of the birds in this section of the exhibit was distinctly good. The awards were made by Mr. G. R. Andrews, of Fresno, California, who visited the islands for this purpose.

HAWAII EXPERIMENT STATION EXHIBIT.

The Hawaii Federal experiment station displayed a very effective exhibit. Prominence was given to cotton, which is at present causing so much attention locally as a prospective Hawaiian crop. Tobacco and rubber were also given recognition, which crops together with cotton well represent the potential agricultural energy of the Territory which the station is doing so much to develop.

[1] From the Hawaiian Forester and Agriculturist, Vol. VI, No. 2, February, 1909.

One feature of the display was particularly satisfactory to the forester, for it represents in concrete form the efforts which are being made to develop our own resources and to make our islands independent of other sources of supply. The specimens of bales of rice hay and rice straw are alluded to—the former especially being of such quality as to encourage the hope that it will eventually command much of the local demand.

A house constructed of beeswax, together with an observation hive in operation, and specimens of bee products represented the local honey industry.

BUREAU OF FORESTRY EXHIBIT.

The bureau of agriculture and forestry was well represented by a display from each of its divisions. Of these the one attracting special attention was the entomological exhibit. It is satisfactory to note from year to year the increasing interest which is being given to this phase of economic agriculture—a result no doubt due not only to the vital part which insect problems play in our local industries, but in particular to the judicious policy of education which is carried out by the division.

The collection shown by the division of forestry well displayed the progress of conservation throughout the islands and epitomized the multifarious work which fails to the lot of this division.

LECTURES.

An agreeable innovation was made by the lectures of Prof. B. E. Porter, of the College of Hawaii, on Thursday and Friday evenings. These included the selection and care of poultry and were illustrated by lantern slides.

POULTRY RAISING IN HAWAII.[1]

Poultry culture has many peculiar and particular attractions to old and young. A fine flock of well-kept fowls is certainly a very great pleasure as well as a source of income to the family. And the care of poultry offers ample opportunity for the abundant exercise of both brains and muscles by men and women of almost all conditions of life.

Whenever poultry is kept, it is with a definite purpose in mind. Such a purpose may be for pleasure or profit, or both. Many families keep a few fowls to use up the waste food materials about the home, furnish fresh eggs, beautify home surroundings, or provide recreation to the head of the family when he comes home from professional duties. Then besides all this pleasure the profit which can be derived is no mean item for any family to consider at the present time.

When poultry is kept for profit alone this situation changes. Then it is more serious business, for so many problems confront the poultryman. Some will immediately say, "What must I do to insure a reasonable amount of success?" The answer is, study and work.

[1] By B. E. Porter, Professor of Animal Husbandry, College of Hawaii.

There could certainly be no more favorable conditions for poultry keeping than we have here within our own midst. In fact some men are frank enough to say that things are almost too favorable, so that people do not take the necessary precautions and care for their fowls. It is true that some grain foods are high, but market prices to the Army and Navy, together with the advance in prices of meats, make the opportunity for successful poultry keeping so much more promising.

Statistics are dry things, but sometimes they show results that are a revelation to the uninitiated. According to the bureau of statistics, the value for the import of eggs alone has been for 1906, $12,995; 1907, $14,943, and 1908, $16,511. These figures show an increase of almost $2,000 each year. For a young man with enterprise and push such figures look particularly inviting, for there is a possibility that he can have a goodly share of such money as returns on his business.

At best, poultry raising can not be carried on in a haphazard sort of way or because a neighbor makes $10 a week with fowls. To make a profit on poultry, as in any other line of successful business endeavor, the personal equation must be solved. An inventory of personal habits and characteristics is essential.

QUALIFICATIONS OF A POULTRYMAN.

In order that this taking account of stock may be thorough and quite complete, let us consider what these qualities may include.

First of all he must have a particular liking for animal life and, you may say, a love for good, lively, healthy looking birds. He needs the qualities of the brightest merchant. To be successful he should be sagacious and shrewd, capable of planning well and executing completely.

To get along well he must have a system developed in all its details, and be regular in his habits. The crowning characteristic is the quality termed "common sense." Then, again, he must be a student of market requirements, tireless in his attempts to satisfy a market with high quality poultry products put up in attractive packages. He should be a student of principles of breeding, methods of improvement, and factors of feeding and never be self-conceited, which limits progress.

Let the poultryman decide to make poultry his life study, using the instruction gained, profiting by the experience of other poultrymen, acquiring wisdom from his own successes and failures, and always welcoming any new practical ideas which will help on his poultry progress.

LOCATION OF POULTRY YARDS.

For the beginner, the location of yards or the amount of land which can be utilized for poultry must receive attention first. It does not take much room for a small flock, but chickens do best with plenty of range. Some of the mainland experiment-station workers have found that a four months' chick on fresh range would equal in weight a five months'

chick on the old range. A place with some sand in the soil is preferred for the reason that it allows more perfect drainage in wet weather.

The necessary buildings for the beginner, in this climate, need not be very expensive. The principal thing in building, however, will be protection against wind, rain, dampness, rats, and other pests. Trees and hedges can be made to afford protection from the sun if the hens and little chicks so desire. It is also, quite often, desirable to screen in the roosting quarters so that the hens may be free from annoying mosquitoes at night.

SELECTING STOCK.

When commencing poultry raising it is advisable to select stock for a particular line of production. Let the stock be noted for egg production or fancy broilers. The market is good for both kinds of birds. Do not have dual-purpose fowls. Have specialists; then the breeding and feeding are more easily solved.

For egg production, select breeds from the Mediterranean class, and for broilers choose an American or Asiatic variety. An American or Asiatic fowl may lay as many eggs as the lighter breeds, but when results are totaled the economy of production is usually in favor of the smaller hen, because her cost of maintenance is less.

To have a flock of good laying hens, special attention must be given to their selection. If possible, get pullets from breeders who are reliable and are known to have good birds.

Ordinary fowls may do until the flock can be replaced by others from a breeding flock which has been selected with special care.

The inexperienced poultryman will find that breeders recognize that a laying hen has a particular type and form closely correlated with egg production. A laying hen is not fat. She has a red comb, a clear eye and a hearty appetite. In form she has a long body, wide in the breast for a large craw, flat and wide in the back and is not heavy in the region of the fluff.

The male bird for the breeding flock should not be anything but the best. A knowledge of the laws of breeding will help the beginner to understand why good prices are asked and received for superior stock.

After the buildings are built and the fowls put in the yard, real work begins. Care must be given to the feeding so that the hens will not get overly fat and cease laying.

Vermin and disease must be kept off the fowls. Water, grit, and shell-forming materials are needed. Records should be kept so that the poor-laying hens can be removed from the flock. Trap nests are valuable for such work. Many who were at the recent poultry show remember the model presented by the College of Hawaii.

The recent exhibition was a decided help. There breeders brought together the results of their best efforts, which were, indeed, highly commendable. The fowls exhibited showed high quality and gave evidence

that some masters in the art of breeding and conditioning stock had been at work. Their work fully demonstrated the fact that they were close students of superior fowls and the Standard of Perfection, which, by the way, should be in the hands of every breeder.

Poultry culture is a vocation which gives ample opportunity for the deepest study, unlimited play for the best talents, and abundant room for the most skillful practice. The poultryman of to-day, who is equipped with a natural inclination for the calling, interested in the industry, trained in all the care and management of the fowls, especially educated for the business and not afraid to work hard with both brain and brawn, is prepared to act with intelligence and may become not only a successful breeder of thoroughbred poultry and producer of high-class poultry products, but also a public benefactor and an honor to his State and country.

FOUR YEARS' EXPERIENCE GROWING RUBBER TREES ON BASILAN.

By Carl F. Miller.

The samples sent to the Bureau of Agriculture are the product of the Ceara rubber tree (*Manihot glaziovii*). There are in Basilan three rubber plantations, Dr. J. W. Strong's, the San Rafael agricultural farm, and my own. In my district there are, outside of my plantation, a few trees planted by natives around their houses, more for curiosity than for commercial purposes. The trees from which I tapped the rubber for the samples were planted and cultivated by me personally and at the time of tapping were 3 years and 6 months old. These trees were grown from imported seeds and planted at stake in newly cleared forest land of a rich clay loam. Hemp and rice were planted at the same time as secondary crops.

On my plantation I set out 1,000 seeds; the seeds were previously filed to facilitate quick and uniform germination, and incidentally it gave the ants and other vermin of the ground a chance to eat the kernels before germination could take place, causing a loss of at least 50 per cent of the seeds. The weeding which was necessary for the cultivation of the rice and hemp caused the loss of many young rubber plants which at that time were about 6 or 8 inches high, being between rice and weeds made them rather difficult to detect. The result was that many of them were pulled up with the weeds or smothered by having weeds thrown on top of them. This latter loss could have been avoided by placing a stake at each place where I planted a seed. Out of the 1,000 Ceara rubber seeds planted only a little over 100 trees were raised, due mostly to inexperience in the beginning.

GERMINATION.

The seeds may be planted without filing, in which case the ants can not destroy them, but if not filed they will take from three to six months for germinating; if under moisture and heat they will germinate sooner, but at best germination will be uncertain and not at all uniform, so that planting the seeds unfiled may be considered a failure in the beginning.

The nursery.—In this case we will have to resort to a nursery in which to sprout the filed seeds and transplant them to the field afterwards;

this may be done more or less successfully, but with the best of success it leaves a lot to be desired. It is no end of trouble to clear a large plot of land and free it from ants and insects; even if perfectly free from ants, they will get in before the seeds can germinate and destroy a large percentage of them. The subsequent removing and transplanting of the seedlings from the nursery to the field is simple enough; any native can do it with fair success so far as the living of the seedlings is concerned, because the Ceara rubber seedlings are very hardy and stand transplanting fairly well, but that is not all; the most important point is to get the roots placed in their proper position, the reason for this I will explain.

The young plants in the nursery make their first appearance above ground in the same manner as the coffee bean, or any other bean for that matter; that is, the seed is borne up, the kernel makes the first two primitive leaves, but the root system seems out of proportion in comparison with the size of the young plants. On examining seeds in the nursery you will find that before the seeds ever make their appearance above ground they have developed roots from three to five in number with a taproot very long and delicate that seems to be inclined to go right to the bottom if the bottom is to be found.

Transplanting.—So you can see that by the time the plants are old enough to stand transplanting, which is about ten to fourteen days with their rapid growth, they have large but delicate roots, and as for taking them up with sufficient soil adhering to the roots so as not to cause injury, it is practically impossible, unless the seeds have been given plenty of distance, and the soil is of the right consistency; even then, the subsequent handling of the plants in transplanting will invariably remove it, so that the roots will be bare. Here is where the important point above-mentioned comes in; that is, to get the taproot straight down, and the side roots equally divided on all sides. On examination of newly transplanted seedlings you will probably find that the taproot instead of being straight down is doubled up or pointing upward, and the side roots instead of being equally divided are all on one side and in all sorts of shapes and forms; all this may seem of little importance to the causal observer, who is apt to say "What is the difference which way the roots are placed if the tree grows all right?" and he may be right so far as other kinds of trees are concerned, but in the case of Ceara rubber it is of the utmost importance that the roots be in their proper position. The results from lack of attention to this item when transplanting are sure to manifest themselves sooner or later.

It is a well-known fact that Ceara rubber is a very shallow feeder and a poor resister of winds. The wood is hard and brittle and a heavy wind will splinter it all to pieces, sometimes the whole top will snap off, leaving a bare stump standing; and after a heavy rain, when the ground is loose, a light wind will often push the tree over, pulling it out roots and all;

trees that have the roots all on one side will invariably fall over under their own weight.

I have seen very fine, large, and otherwise apparently flourishing trees down after a heavy rain, and for no other reason except that all the roots were on one side, and the taproot, instead of being straight, was curled into a sort of spiral and had no holding power at all. It may seem strange, but it is a fact that the Ceara rubber tree does not grow any new roots as it grows older and larger, with the exception of small feeding roots which branch from the main roots. There is absolutely no duplication of the main roots, so that if a seedling is planted with the roots badly placed it will always remain a badly rooted tree. From these facts it may be seen that it is important to have the roots properly placed when transplanting rubber trees.

A method of germinating.—I have tried various ways of sprouting the seeds before planting them in their permanent place in the field. The best results were obtained in the following manner:

Select a moist but not too wet spot in the field where the rubber seeds are to be planted, dig a hole about 3 or 4 feet in diameter and about 2 feet deep, take out all of the dirt and make the bottom smooth, then scatter about 1 inch of dirt evenly over the bottom, take the rubber seeds and scatter them thickly all over the loose dirt in the hole, then take a basket or a box with a perforated bottom and place it over the seeds bottom up, take an empty sack and place this over the basket or box, whichever the case may be; when this has been done cover the basket or box with the dirt that was taken out of the hole so that there is about 12 inches of dirt all over and around the basket. The seeds must be filed, and it is a good plan to soak them in water for about twenty-four hours before sowing them in the hole.

After three days uncover the basket or box, being careful to remove all dirt before taking the basket or box away. You will find that a large percentage of the seeds have sprouted; that is, the sprouts are just coming through the seeds, some of them may have already taken root. You can then pick out all those that have sprouted and plant them in their permanent place in the field; the ants will not harm them after they have reached this stage. The seeds that have not sprouted must be covered up again, and after twenty-four hours repeat the operation, and so on until all of the seeds have been planted. The field should be previously prepared, the hole should be dug, that is, the soil should be loosened up 3 or 4 inches deep, and a stick placed at each hole where the seeds are to be planted. The planting of the sprouted seeds is very simple. Make a hole about 1 inch deep in the loosened earth, put the seed in with the sprout down, cover lightly, being careful not to step on or press down on the newly planted seed with your hand, the first rain will do that much better and without injury to the sprout.

If the above-described method of sprouting and planting the seeds is followed, three or four men can plant a large field in a day, and every seed will grow. The result will be a field of uniform and well-rooted trees, which is exactly the opposite of what might be expected from seedlings grown in a nursery.

PLANTING CUTTINGS.

Plantings may be made from cuttings and sometimes they will make fine trees; but as for planting a field from cuttings, it is not advisable, for a large percentage of the cuttings will not make anything worth calling a tree.

PLANTING YOUNG SHOOTS.

Select a tree that has branched very low from the ground but is otherwise in good shape and growing vigorously, prune out the whole top; that is, cut out everything except the primary and secondary branches, leaving no branch that is not at least 2 inches in diameter, because shoots from small branches will not amount to anything. A tree that has been treated in this manner will in a few days send out strong and vigorously growing shoots all around the edge of the cut-off branches. When these shoots are about 8 or 10 inches long, they are then ready for planting. Do not break them off, but remove them from the tree by cutting; care should be taken to leave a little of the bark and wood from the tree attached to the shoots. These shoots are very tender and should be given shade for a few days; they will take root very quickly, and after they are once started will grow vigorously, growing even faster than trees grown from seeds.

PRUNING.

It has been stated that on rich soil the Ceara rubber tree makes a very heavy top and that it is a good idea to prune it rather severely. My own experience with pruning has been both instructive and suggestive. I firmly believe that pruning does other things to the trees beside saving them from being blown to pieces by heavy winds.

As I have said before, it is a well-known fact that Ceara rubber is a poor resister against heavy winds, and if not protected or planted in a locality where wind storms do not prevail, or can not do much damage, they will be splintered, or very severe damage may be the result of a storm. But to effectively prune a large number of trees is not easily accomplished, and I believe the results of severe pruning manifest themselves along other lines later on. I will state my reason for this.

When my first trees were about eighteen months old they were in just this top-heavy condition; although well protected by surrounding forest I thought it best to cut out some of the branches of the most vigorously growing trees. To do this I had to use a stepladder, most of the trees being big and strong enough to allow me to stand in the forks to do the cutting; but I soon found that I had to do the cutting from below the branches

because cutting from above would result in splitting, often one light cut from a bolo would cause a branch to sag and split down the branch of the main trunk. I tried cutting from below by standing on the ladder; cutting half through a branch from below with a small cut from the side would generally result in a clean break off.

After treating some twenty trees in this manner, I decided to let the rest of them take their chances with the winds, because in doing this cutting from below, latex would trickle from every cut and run down my neck, arms, and all over me, and everything I came in contact with would stick to me; so I promptly decided that the rest of the trees did not need any pruning.

The next time I paid any special attention to these trees was at the time of tapping, when they were 3½ years old. The first day of the tapping I noticed a marked difference in the quantity of latex produced by individual trees; upon looking into the matter I found that I had most of the pruned trees included in the fifty trees that I had selected for tapping. During the period that I carried on the tapping I discovered that every tree that had been pruned gave rather below the average amount of latex and the bark of these trees was below the average in thickness, although at the time of the pruning they were the largest; they were not above the average size and had not kept up with the other trees.

The trees that gave the most rubber were only about 8 inches in diameter with a trunk of 6 or 8 feet to the first branches, of a conspicuous appearance, with a very large spreading crown. The outer bark as well as the rubber bark is of a yellowish color, the latex also is of a yellowish color and the trees have a rubber bark that is considerably above the average in thickness. Although the trees are of the same species, they are probably of a different variety.

The trees which gave the smallest amount of rubber were about 12 inches in diameter with a very fine, smooth trunk of from 10 to 14 feet to the first branches; the rubber bark of these trees was very thin and the latex was of rather a watery consistency and would flow for only a short time. I was rather disappointed in these trees, because I had anticipated rather the opposite results.

TAPPING.

I first prepared fifty trees for tapping; the preparation consisted in removing the outer bark from the trees as high as I could reach from the ground, which is about 8 feet, with the exception of a few trees whose first branches were below 8 feet, but most of them began branching at from 10 to 14 feet from the ground. The outer bark removed and the receptacles and drip cups having been prepared for use the night before, the trees were ready for tapping the next morning. The receptacles used were ordinary Chinese tea bowls holding about half a pint

of latex, the drip cups were zinc cups about half the size of the ordinary condensed-milk can.

I commenced tapping about 6 o'clock in the morning and finished tapping fifty trees about 10 o'clock. I used the herring-bone system which consists of a vertical cut from as high as I could reach from the ground to about 6 inches from the base of the tree, with side cuts about 10 inches apart at a slant so as to afford free running of the latex into the perpendicular cut, where the ammoniated water from the drip cup carried it down into the receptacle at the base of the tree. The tools used were a pair of Ceara tapping knives, one for right and one for left laterals.

When ready to begin tapping, place the receptacle at the base of the tree; take a piece of tin about 3 inches long and one-half inch in width which has both edges bent up to give it a sort of gutter shape, shove this tin into the inner bark of the tree a little above and with an easy slant down into the receptacle; then take one of the knives and begin immediately above the tin gutter and make the perpendicular cut about breast-high, then reverse the knife and begin at the top and cut down, leading into the cut already made; place a drip cup at the top, immediately above this perpendicular cut, and pour into the drip cup a solution of about one-half of 1 per cent of ammoniated water. After this has been done, make the side cuts or laterals leading into the perpendicular cut. The drip cups have a little hook on the upper edge for hooking them into the bark of the tree, they also have a little round hole in the bottom in which is placed a wicker so as to give a slow but constant drip. The opening of each tree requires only a very few moments; it took me about thirty minutes to open the fifty trees.

Too deep cutting.—The Ceylon Ceara tapping knives work fairly well but are dangerous in the hands of inexperienced and careless laborers. Great care should be used not to cut too deep; if the cambium bark is cut through, the healing of the wounds will be slow and will not be smooth, but will give the tree a ridged appearance, and besides it is liable to cause inconvenience in later tapping. Too deep cutting exposes the tree to insects, which, if not attended to in time, will cause the tree to decay and finally die. I have trees that were cut too deep which were attacked by borers, apparently the same kind that bores into any kind of wood, but the trees do not seem to suffer any damage from these borers, the rubber bark heals up and closes in so as to exclude the insects. There is, however, an insect that attacks the trees that have the wood exposed from too deep cutting or have been otherwise injured; this is a very formidable grub that undermines and apparently eats up the rubber bark. I believe it is caused by a moth which deposits its eggs under the bark on the edges of the wounds.

After all the trees were opened up, I went from tree to tree to see

that the drip cups were properly dripping, which is very important and must be given close attention. If for any reason the flow of ammoniated water from the drip cup stops, the latex in the receptacle at the base of the tree will coagulate almost immediately and the flow of latex from the tree will be stopped because the latex coagulates in the horizontal cuts if there is not sufficient flow of ammoniated water to carry it along. Some of the cups may drip too freely and run dry before the latex stops flowing from the tree; all this must be avoided because any rubber which coagulates in the receptacles or on the tree can not be included in the final coagulation and therefore is not purified and can be sold only as scrap. After about one hour the flow of latex stopped, when we began the collection of the latex. For this I used ordinary water buckets, going from tree to tree pouring the contents of the receptacles into the buckets and carrying it to the house. After the collection the coagulation begins, which I did in the following manner.

COAGULATION.

First pour the latex through a strainer to take out all impurities, such as bits of bark, insects, etc.; then pour the latex into tin basins and mix it with a solution of acetic acid—care must be taken to use only sufficient acid to counteract the ammonia which was used during the tapping—too much acid will cause instant coagulation and the rubber will be in lumps or something like our milk and not at all uniform.

THE PRODUCT.

In from three to four hours the latex will have fully coagulated, when the water, ammonia, and acid can be poured off, leaving one solid mass of spongy milk-white rubber, which by pressure with the hands will expel most of the remaining fluid. When reduced to about one-half inch in thickness I put it through an ordinary clothes wringer to expel the remaining water and to give it uniform size. The resulting cakes were then placed in the shade where the hot air could dry them. When perfectly dry these milk-white cakes turned to a beautiful amber color, almost transparent. In this form the product may be put on the market, although on modern rubber plantations these cakes or biscuits are worked over and pressed into blocks before putting them on the market.

Inasmuch as this tapping was only experimental, and as I did not care to drain the trees by unnecessary tapping, this work was continued for only three days; that is, I tapped the same fifty trees for three successive mornings. The amount of dry rubber obtained during that time was 5 pounds, which was almost dry when weighed, with the exception of some of the last cakes or biscuits. However, no allowance was made for the loss of rubber occasioned by the scrap, of which there was considerable, owing in most cases to coagulation of the latex in the receptacles. As

this scrap could not be included in the final process of coagulation, and therefore is not included in the 5 pounds, I believe that if it had been included it would more than make up for the moisture in the last cakes or biscuits.

Summing up the results, we have 5 pounds of rubber from fifty trees, each tapped three times, which gives us an average of a little over one-half an ounce to the tree for each tapping, or, in other words, the fifty trees gave a little over 26 ounces daily. Supposing the tapping had been carried on for twenty days, this would have given us 10 ounces of rubber for each tree. It is claimed that the flow of latex increases considerably after five or six days, when a proper flow toward the cuts has been established, so that 10 ounces per tree ought to be obtainable. But let us be on the safe side and put the amount at one-half pound per tree—surely the results obtained will guarantee that amount. From this it may be seen that at the present price of rubber a plantation of 100,000 trees would give a good profit to the owner, and that is from trees only $3\frac{1}{2}$ years old; these same trees at 5 or 6 years of age may reasonably be expected to yield between 1 and 2 pounds per tree yearly, and I am certain that some individual trees will go above that amount.

SOILS.

The Ceara rubber tree is said to be a great drought resister and will grow on almost any kind of soil. In Brazil where the trees were probably first found, and in the dry Province of Ceara, Ceara trees are said to flourish on a sandy and rocky soil with very little rain. This, however, does not mean that the tree will not thrive on a rich soil with plenty of rain. Experiments made here on Basilan and at other places in the Moro Province go to prove that on a rich soil, with plenty of rain, the trees will grow to be from 8 to 12 inches in diameter in three years, and will produce a large amount of rubber of excellent quality. It is generally claimed that a well-drained soil is essential to the welfare of Ceara rubber. I do not believe that it would grow in swamps, but I do know that it will get along nicely on perfectly flat land with very poor drainage. I have on my plantation a number of 2-year-old trees which I planted on well-plowed land on which hemp was planted at the same time. One end of this plot of land has very poor drainage; the water of the rainy season will stand there at times from two weeks to a month, and the soil will be so loose that it will not stand walking on without sinking down to the ankle. The hemp on this piece of land never did thrive well and most of it has died out altogether. I also planted a few Para rubber seedlings on this land, and although they are growing they are nothing in comparison to the others that I planted on higher and well-drained ground, but the Ceara rubber trees on this wet lowland are flourishing and do not seem to mind having wet feet for a month at a time; in fact, some of

these trees are larger and better shaped than the parent trees from which I selected the seeds. I also planted a number of trees on well-plowed ground, leaving out the hemp, and instead planted corn for the intermediate crop. Two crops of corn were grown in between the rubber trees, but every one of those trees branched low and is otherwise stunted and deformed; this resulted from the cultivation of the corn, which was done with a one-horse cultivator. In going over the ground several times with the cultivator most of the surface roots of the rubber trees were either torn out or otherwise injured by the cultivator. Deep and well-plowed ground is favorable to very rapid growth, but the after-cultivation should not be done with draft implements, or at least deep-toothed implements should be avoided, because permanent injury to the tree will result from using them.

The rapid maturity of this variety in itself makes it the most desirable for experimental work, because it does not require from ten to fifteen years to find out whether you are working along the right lines or not. I also have several hundred Para rubber trees on my plantation; these are a part of some 20,000 seedlings which the Bureau of Forestry of Manila supplied to the government of the Moro Province. These plants were widely distributed and in most cases have made fine growth. Those on my plantation were planted among young hemp trees, and have made a very fine growth.

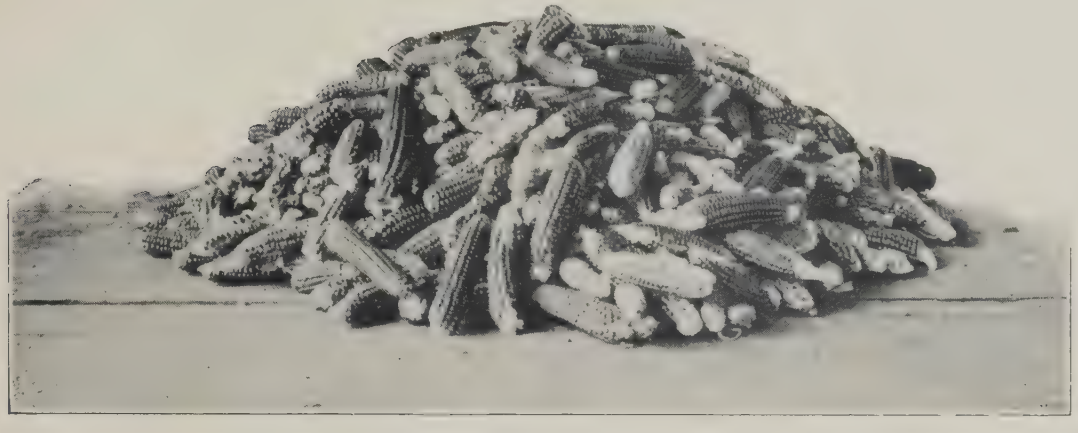
Para rubber seems to be just the thing for planting in between hemp, on account of the slower growth and high branching. The Para rubber tree is not likely to seriously harm the hemp for several years at least. On the other hand, the young plants seem to be benefited by the shade which the hemp affords, and the constant humidity of the soil in a hemp field seems to be just what the rubber desires, and the refuse from the hemp makes good manure for the rubber trees. In tapping the Ceara rubber I noticed that where the thoroughly decayed refuse was which resulted from the hemp stripper having been put up under the shade of the rubber trees, the trees gave more than double the amount of latex. which was of a much thicker or creamier consistence than that produced by the other trees. By going over the field and trying the trees which had been used for shade by the hemp stripper I found that every one of them produced a very free flow of heavy latex.

There are also a few Castilloa rubber trees on Basilan; the first were planted on the San Rafael agricultural farm in 1905 and although they were planted between sugar cane they have made a fine growth and are now fine, large trees.

The Moro Province has large tracts of the finest kind of virgin soil only a few miles from the coast, but the general conditions of a mountainous country with no roads make this place almost inaccessible and otherwise unsuitable for planting coconuts. In the case of rubber,

however, enough seeds to make a big plantation can be carried inland and the final product can, if necessary, be carried out in 25-pound lots; and then we are far ahead of the man that has to haul and handle tons of bulky stuff and receive only a small profit on it. The upland valleys of rich soil naturally protected by surrounding mountains are supplied with fine streams of water that afford irrigation almost for the asking. We have the finest coffee and cassava in the world growing almost wild. A plantation of Para rubber with coffee and cacao as an intermediate crop under irrigation would prove a very safe and profitable investment for capital if well managed.

Uncultivated rows one meter apart (10¼ pounds).



Cultivated rows one-half meter apart (69¾ pounds).

Cultivated rows one meter apart (99 pounds).

PLATE III.—THE RESULTS OF CULTIVATING MAIZE OR INDIAN CORN.

THE IMPORTANCE OF AGRICULTURAL EDUCATION FOR CAPIZ PROVINCE.[1]

By R. L. CLUTE, *Agricultural Inspector.*

One of the most important questions that is before the people of Capiz Province is, "How can we make more money?"

When the railroad is completed we can travel to Dao, Dumarao, or to Iloilo with the greatest of comfort. The people who live along the line can easily exchange their farm products with Capiz or Iloilo merchants for farm machinery or store goods. Gravel and broken rock are being placed on our public highways. Permanent bridges are being built, good ferries established, and in a few years our public roads will be in excellent condition. The steamship service has been improved so that we now have several boats each month to Manila and to Iloilo. This transportation question that has been so difficult in the past is rapidly being solved. The railroads, the steamships, and the good public highways are all for the convenience of the people and indicate progress in civilization. We are on the road to prosperity, and if we all pull together success will be sure and permanent.

If you travel on the steamboat or on the railroad you must pay money. If you purchase food, books, clothing, or a cedula you must pay money. If you build churches, schoolhouses, or homes you must pay money. All of these are necessary for better living. In order, then, that we may make progress and enjoy more of the necessities and luxuries of life, how can we make more money? There is only one way to get an honest peso and that way is to work. We must work to advance in civilization.

If you travel in different parts of this province you will notice that the soil is covered with a luxuriant vegetation. This shows conclusively that this is a good place for plants. It is recognized by all that our great source of wealth must come from plants such as rice, sugar cane, tobacco, coconuts, etc. Our efforts then should be to produce them in larger quantities, for we can sell for cash all the sugar, rice, or tobacco that we can raise.

Plants grow according to certain laws of nature. If you wish them to grow rapidly and produce large crops, they must be supplied with a certain amount of food, water, air, and sunshine. A man who eats

[1] An address before the Capiz Agricultural Society, April 13, 1909.

too much or a man who eats too little can not work as well as a man who eats just enough. Just so with the plants. If they have too much food, water, sun, or air they do not grow well. The successful farmer knows just what plants want to grow well and gives it to them. We must dig the wild grass and shrubs from the fields and hills and plant sugar cane, rice, tobacco, etc. You say these plants are now being cultivated and that you know all about growing them. There has never yet lived a man who knows all about plant growth. New things about plants are being learned every day.

Three years ago, while teaching agriculture at the Philippine Normal School, the pupils and I conducted several experiments with corn. A field was thoroughly plowed and harrowed and divided off into six plats of equal size. The entire six plats were planted with ordinary yellow seed corn. The soil in one plat was not cultivated. The surface soil there became hard and the grass and weeds were allowed to grow between the rows of corn. In another plat the soil between the rows was hoed several times during the growing season. The grass and weeds there were all killed and the surface soil was made soft and fine. This plat produced 99 pounds of corn, while the plat that was not hoed produced only $10\frac{1}{4}$ pounds of corn. The boys with the hoe gained $88\frac{3}{4}$ pounds of corn. I have seen many fields of corn near Calivo and Malinao that were not cultivated. The weeds and grass were allowed to grow between the rows and the surface soil was allowed to become hard. Those farmers harvested a $10\frac{1}{4}$ pound crop of corn, while with proper cultivation the harvest might have been 99 pounds. The schoolboys learned from this experience that it pays to cultivate corn. Do not believe this because I say it is true, but try the experiment, if you are interested, and you will learn the *truth—for plants are always truthful.*

In another plat where the corn was planted in rows one-half meter apart the yield was $69\frac{3}{4}$ pounds and in another plat where the rows were 1 meter apart the yield was 99 pounds. Twenty-four and one-half pounds of corn were gained by having the rows a proper distance apart. A small crop of corn is secured if the plants are too close together. I have never tried the experiment with coconuts, but I believe that if they are planted too close together they, too, will produce a small crop. Coconut trees in Capiz Province are often planted 2, 4, or 6 meters apart. It is said by men of experience that these trees produce the largest number of nuts if planted 9 or 10 meters apart.

Is there anything to be learned about rice culture? One farmer at Naysud, a barrio of Ibajay, was afraid to have his carabaos inoculated with serum. Later his six carabaos died with rinderpest. His neighbor, who believes in serum and who has had his animals inoculated, now has carabaos to till his rice fields.

The farmer who cultivates his corn and sugar cane during the growing season will harvest a larger crop than the farmer who neglects this tillage.

The farmer who plants his coconuts 10 meters apart will probably harvest more fruit than the farmer who plants his coconuts 2, 4, or 6 meters apart. The farmer who believes in the value of serum can grow a larger crop of rice than the farmer who through ignorance allows all his carabaos to die.

A farmer who has learned by experiments how to grow large crops of rice, coconuts, tobacco, and corn can gain more money than the ignorant farmer. The intelligent farmers of Capiz Province and the best farmers of Europe and America are those who understand most about plant and animal growth. In Dr. Barrows's annual report he writes, "The hope of the common people lies either in possessing small farms or engaging successfully in lines of trade which will contribute generally to the commercial development of the Islands."

What is needed in Capiz Province is a large number of intelligent farmers in each barrio. With their assistance rinderpest could be suppressed and the crops of rice, sugar cane, tobacco, coconuts, etc., increased. How can we get these intelligent farmers in each barrio? There is only one way. Teach the boys and girls in our barrio schools how to live there successfully and contentedly. Agriculture should be taught in every school in this province. The last school report credits Capiz Province with 179 teachers and 19,000 pupils. These children are being taught the three R's and a certain amount of industrial work, but the imparting of agricultural knowledge is hardly started. I have traveled in nearly all parts of this province and have observed agricultural field instruction in only five schools. Simplicio Bitoon at Pilar and Agapito Protasio at Sigma have made excellent beginnings. Do the people in Capiz Province want practical agriculture taught in the schools? I have talked this matter over with nearly every president in the province, and with many leading people, and I have yet to find one who is not heartily in favor of agricultural instruction in every school. This study if properly introduced will not crowd out the regular studies, but will, on the contrary, be a help in making reading, geography, drawing, composition, and even arithmetic more interesting.

Since economic plants and domestic animals are the foundation for our prosperity, let us study them with a will. The carabao, the king of the rice paddy, should be protected from unnecessary sickness. Our horses and pigs and other domestic animals should be protected and improved. Let us educate a generation of farmers who will change the waste fields and hills of Capiz Province into a beautiful agricultural garden. Nature has done her part, the soil, the air, the water, the plants, and the animals are here. Just one thing is lacking—a large number of people in the barrios who have agricultural brains. These people can be had if practical agriculture is taught in our schools.

Let us ask the educational department if they will not establish practical agricultural education *in every school in Capiz Province.*

NOTES FROM OTHER FIELDS.

COMPARATIVE TABLE OF CULTIVATED RUBBER EXPORTS FROM THE FEDERATED MALAY STATES, 1908 AND 1909.[1]

Locality.	Exported during February, 1909 (pounds).	Previously (pounds).	Total exported during 1909 (pounds).	Export during similar period of previous year (pounds).	Increase (pounds).
Selangor[a]	60,249	52,727	112,976	71,241	41,735
Negri Sembilan	224,520	202,889	427,409	272,142	155,267
Pahang	76,656	89,977	166,633	125,012	41,621
Total	361,425	345,593	707,018	468,395	238,623

[a] Of the rubber exported from Selangor during February, 1909, 2,787 pounds were produced in Perak and 6,983 pounds in Negri Sembilan.

KUALA LUMPOR, *March 10, 1909.*

J. R. O. ALDWORTH,
Commissioner of Trade and Customs.

COFFEE AS A CATCH CROP WITH RUBBER.[1]

GOLDEN HOPE STATE KLANG, *February 27, 1909.*

DEAR SIR: The following may be of some interest to your readers who may have planted coffee as a catch crop with rubber or planted rubber through old coffee plantations in alluvial soil.

The figures given show the result of the work for the year 1908 on this estate.

Area planted.	Planted with coffee (10 by 10).	Interplanted with Para rubber (30 by 15).	Yield of clean coffee per acre, 1908 (piculs).
30 acres	13 years ago	April, 1905	$5\frac{1}{8}$
35 acres	do	do	$3\frac{1}{2}$
35 acres	do	do	$5\frac{5}{7}$
33 acres	do	do	$6\frac{2}{5}$
27 acres	$12\frac{1}{2}$ years ago	Not interplanted	10
152 acres	1 year, average	April, 1903	$1\frac{4}{5}$

Your obedient servant, EDMOND B. PRIOR.

PEANUT CULTIVATION IN BURMA.

A recent number of the Indian Trade Journal mentions that groundnut (peanut, *Arachis hypogaea*) cultivation has, of late, increased rapidly in Burma. For the year ending June 30, 1908, the total area planted with this crop reached 142,051 acres, compared with 78,743 acres in the

[1] From the Agricultural Bulletin of the Straits and Federated Malay States, Vol. VIII, No. 4, April, 1909.

previous season. In order to foster the industry, the Government is distributing seed nuts, which are repaid at harvest time.[1]

COTTON-GROWING EXPERIMENTS IN THE HAWAIIAN ISLANDS.

A report from the Hawaiian Islands states that experiments are being made in cotton cultivation, the varieties under trial being the sea island, Caravonica, and Egyptian cottons. Breeding work has been started over an area of 5 acres, and 10 acres have been laid out for manurial trials with cotton planting; it is probable that the crop will be grown over an extensive area next season, since large numbers of applications for selected sea island and Caravonica cotton seed have been received at the experiment station.[2]

THE PRODUCTION OF SUGAR IN CUBA.[2]

Table showing the amount exported and on hand on March 31, 1909, compared with the figures for the same date in 1907 and 1908.

Locality.	1907.		1908.		1909.	
	Sacks.	Tons.	Sacks.	Tons.	Sacks.	Tons.
EXPORTED.						
Havana	453,426		311,828		370,814	
Matanzas	534,539		302,001		449,726	
Cardenas	464,284		432,149		509,446	
Cienfuegos	844,568		594,777		734,504	
Sagua	277,311		102,972		258,825	
Caibarién	229,516		206,617		244,314	
Guantánamo	180,324		135,527		198,613	
Cuba	38,931		26,392		31,500	
Manzanillo	237,859		187,569		231,431	
Santa Cruz del Sur	23,813		65,375		68,000	
Antilla	75,153		80,080		137,897	
Nipe Bay	45,264		48,480		121,008	
Nuevitas	92,305		71,761		80,921	
Júcaro			21,000		126,100	
Gibara y Puerto Padre	341,103		214,202		308,424	
Zaza						
Trinidad	44,928		28,482		42,500	
Total	3,883,324	554,760	2,829,212	404,173	3,914,023	559,146
ON HAND.						
Havana	675,309		456,530		543,307	
Matanzas	660,741		305,663		409,599	
Cárdenas	595,978		310,526		490,503	
Cienfuegos	485,513		210,349		315,424	
Sagua	225,044		163,563		152,697	
Caibarién	218,083		117,518		167,604	
Guantánamo	100,654		61,770		99,488	
Cuba	10,104		17,627		17,130	
Manzanillo	15,023		10,800		63,509	
Santa Cruz del Sur	33,500		125		5,254	
Antilla	27,200		37,091		4,338	
Nipe Bay	7,600		10,715		23,868	
Nuevitas	33,140		27,130		20,005	
Júcaro			7,500		26,619	
Gibara y Puerto Padre	46,045		10,530		59,760	
Zaza	12,400		16,500		21,200	
Trinidad	3,189		9,111		7,588	
Total	3,149,523	449,932	1,773,048	253,292	2,427,983	346,855
Local consumption	1,017,192		672,405		922,351	
On hand, January 1 (old crop)			9,318			
Received until the 31st of March in the harbors	1,017,192		663,087		922,351	

[1] From the Agricultural News, Vol. VIII, No. 182, April 17, 1909.

[2] From El Hacendado Mexicano, Vol. VIII, No. 173, May 1, 1909.

THE CACAO MARKET OF THE PORTUGUESE ISLANDS.

According to the London Times, the well-known English firms of Messrs. Cadbury, Messers. Fry, and Messrs. Rowntree have decided, after careful investigation of the matter, not to make any more purchases of cacao from the Portuguese islands of St. Thomé and Principe, on account of the slave-like labor conditions in those islands. West Indian cacao should therefore find a more extensive market in Great Britain.[1]

THE DEMAND FOR ANNATTO SEED IN THE UNITED STATES.

In connection with the article by Prof. C. M. Conner, Assistant Director of Agriculture, on "The Annatto Plant" which was published in the December number of THE PHILIPPINE AGRICULTURAL REVIEW, we desire to call the attention of our readers to the following letter from Parke, Davis & Co., importers of drugs at 90, 92, and 94 Maiden Lane, New York:

NEW YORK, *January 14, 1909.*

Dr. G. E. NESOM,
Director of Agriculture,
Department of the Interior, Manila, P. I.

DEAR SIR: We are in receipt of your communication of the 23d of November, No. 7296A3, originally sent to our Chicago office and referred to us for attention, as all matters relative to the importation of crude material are handled by the importing department located at this point. In response we would say that you fortunately have addressed one who without doubt is the heaviest importer of Annatto seed in this country and we should be pleased indeed to receive from you a good-sized sample, say 8 ounces or so, which will demonstrate the quality that can be furnished from the Islands, stating at the same time the quantity that could be supplied, the lowest price c. and f. New York, and when shipment could be made. We also would be interested in having you advise us of the proper season for gathering this article in the Islands, as with this data in hand we see no reason, if the quality of the goods is satisfactory, why business of considerable moment could not be developed.

We thank you for your kind communication, and awaiting with interest your response, remain,

Yours, very truly, PARKE, DAVIS & Co.

A similar letter from Chr. Hansen's Laboratory, Little Falls, New York, dated March 30, 1909, has been received by the honorable the Secretary of the Interior, and referred to this Bureau, from which we make the following extracts:

This article comes to this market from the West Indian Islands, especially from Jamaica and Porto Rico, where the crop ripens during the months of January, February, and March.

It is news to us that annatto is produced in the Philippine Islands, although some has been in the market heretofore from Ceylon and other East Indian countries.

We shall be very much interested in learning more about the matter, when the crop ripens in the Philippines, and also in regard to the quality. If you will kindly see that small samples are sent to us, we will appreciate it.

[1] From The Agricultural News, Vol. VIII, No. 182, April 17, 1909.

The price of Porto Rico and Jamaica annatto varies from 4 to 9 cents [United States currency]. This season we have been paying from 6 to 7½ cents [United States currency]. Contracts are often made in the fall for delivery during February and March.

It is suggested that Philippine growers of annatto seed correspond with these parties.

EGG-LAYING COMPETITION.

The fifth egg-laying competition, under the auspices of the department of agriculture for Western Australia, will commence on May 1, at Subiaco, about 300 yards from West Subiaco railway station. The competition will run for twelve months, to 30th April, 1910.[1]

PEANUT OIL.

In Europe a first-class peanut oil is the most highly esteemed of vegetable oils after olive oil. It is also used in the manufacture of butter substitutes. The low-grade oils are used for soaps.[1]

[1] From Journal of the Department of Agriculture of Western Australia, Vol. XVIII, part 4, April, 1909.

AGRICULTURAL NOTES.

Weather conditions.—According to information recently received, the growing crops are generally in good condition, though they vary in different districts. In Samar the drought has done considerable damage and following, as it does, the devastation caused by the hurricanes during the last four months of last year, has caused much destitution among the inhabitants of the province. Most crops suffered considerably, especially palay, there being little hope of a good harvest in Catarman, Villareal, Gandara, Tarangnan, and many other municipalities of the island. This is also true in Carcar, Mandaue, San Remegio, and Tuburan, Cebu, also in Caramoan, Ambos Camarines, and in some other localities. On the other hand, favorable conditions are reported in the municipalities of Valderrama, Antique, Laoag, Ilocos Norte, Peñarrubia, Ilocos Sur, and especially so in Malilipot, Albay, where the crops appear to be in excellent condition. The crops are in good condition in the municipalities of Bobon, Laoang, Borongan, and Oquendo in Samar, and in the place last named farmers expect a regular harvest of palay and corn.

Rice.—The sowing of rice seed is now general in the rice districts. In some districts the seed beds are being prepared while in others the plants are already growing vigorously, owing to the early rains. In Iloilo the condition of the paddy fields in the greater part of the municipalities could hardly be better. From Haniway, Oton, Santa Barbara, Cabatuan, Leon and other municipalities of this province, and from New Washington, Nabas, Odiongan, and Looc of Capiz good news is received regarding the condition of the rice fields and a good harvest is expected. Rice has recently been harvested in Bulacan, Pampanga, and Tarlac, with fairly good results, and the farmers through the island are now busy breaking up the ground and preparing nurseries for the seedlings. The second harvest of palay will take place in July in the Provinces of Pampanga, Bulacan, La Laguna, and some other sections of Luzon.

Sugar cane.—This crop is doing well in the greater part of Rizal, Cavite, and Pangasinan Provinces, but in several municipalities of Negros Occidental it has been injured by the locusts. The fields present a fine appearance in Carcar and Dalaguete, Cebu; Oton and Santa Barbara, Iloilo; Laua-an, Antique, and other important sugar-growing districts.

Corn.—This product is general in the Islands, at large, being used chiefly as a secondary crop. The provinces of Bulacan, Rizal, La Laguna, Batangas, Tayabas, Ambos Camarines, in fact in a lesser degree all of the provinces of Luzon, have large, fertile fields devoted to the cultivation of this crop. In some places the seed is being planted, while in others the crop is already half grown. Cebu largely surpasses all other provinces in the value of this crop, since it largely takes the place of rice as the principal article of food.

Locusts.—Mr. Pablo Tecson, the superintendent of agricultural extension work, says that the swarms of locusts which have recently made their appearance in the Provinces of Bulacan, Rizal, La Laguna, and Batangas are seriously threatening the corn crops as well as the second harvest of palay. So far the Bureau has had reports of these locusts only in the above-mentioned provinces, but if prompt measures are not taken for their extermination they will soon spread to other regions and devastate the fields. The locusts of the Philippines can travel great distances and even pass over large bodies of water, flying from one island to another. They are the great crop destroyers of the Islands, and it is strongly urged that the farmers all unite in keeping off this threatened calamity. It is now possible to minimize this evil, as the locusts have not yet laid their eggs, and prompt action should be taken. In some municipalities the officials and farmers seem thoroughly awakened to the necessity of adopting active measures against this pest, and a great many men have been capturing them and selling them for food, the price quoted on them in the markets having been as high as ₱10 a cavan. The present price is ₱6 a cavan, more than is paid for rice.

Provincial boards in the provinces affected have been urged to take prompt action looking to their extermination, authority being given under Act No. 83, section 13 (*k*), as amended by Act No. 133, section 1 (6), "To adopt, by resolution, regulations for the suppression of any agricultural pest like locusts or cattle disease, to post the same in five conspicuous places in each pueblo, to provide for the enforcement of the same by fixing penalties for their violation not exceeding one hundred dollars fine or thirty days' imprisonment, to confer jurisdiction to try violators of such regulations upon justices of the peace of the province, and to appropriate money from the provincial treasury for the necessary expenses in organizing the temporary force of employees needed to enforce the regulations and for paying the costs of prosecutions before justices of the peace."

The great importance of destroying the eggs which may be laid has been specially urged by this Bureau. The control of this plague is most important, not only for the sake of the growing corn, but also for the sugar cane and the second crop of palay; a total failure of these crops would be the result of an invasion of locusts like the one recorded

in the year 1903, which was the reason for making the Act quoted above.

Animal diseases.—Samar has suffered but little and reports show that the animals there have been unusually free from disease. We have good news from Batangas, Pampanga, and Siquijor Island regarding rinderpest, and excellent news from Isabela. Marinduque and Bohol report surra to be on the decrease and we hope to have similar news shortly from Nueva Ecija, Cagayan, and other provinces where these diseases still prevail. Our veterinarians are doing excellent work and getting very satisfactory results in checking the spread of animal diseases.

CROPS PLANTED AND HARVESTED AND CONDITION OF SAME TAKEN FROM MONTHLY CROP REPORTS FOR THE MONTH OF APRIL, 1909.

[RICE.—Attention is invited to the fact that rice should be understood as being in the unhulled state.]

NOTE.—75 liters=1 cavan. 63.25 kilos=1 picul. 46 kilos=1 quintal. 11.5 kilos=1 arroba. 0.4047 hectare=1 acre.

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Area.	Quantity.	Unit.
Agusan (reports from 3 municipalities):		*Hectares.*	*Hectares.*		
Abaca	Good	4	12	2,214	Kilos.
Tobacco	Fair	2	2		
Corn	Good	40	4	8,250	Liters.
Albay (reports from 13 municipalities):					
Rice	do	72	8,155	11,672,250	Do.
Abaca	do	1,060	4,349	1,171,200	Kilos.
Corn	do	75	123	39,000	Liters.
Coconuts	do			670,000	Nuts.
Ambos Camarines (reports from 30 municipalities):					
Rice	Fair	157	45	1,375,125	Liters.
Sugar cane	Good	9	162	68,120	Kilos.
Coconuts	do			988,000	Nuts.
Abaca	do	98	4,522	1,054,820	Kilos.
Antique (reports from 9 municipalities):					
Sugar cane	do	85	162	284,625	Do.
Corn	do	344	3	4,650	Liters.
Tobacco	Fair		20	22,586	Kilos.
Coconuts	Good			6,000	Nuts.
Bataan (reports from 7 municipalities):					
Rice	Fair	12	429	1,473,600	Liters.
Sugar cane	do				
Coconuts	do				
Corn	do	3	5	1,650	Do.
Batangas (reports from 14 municipalities):					
Sugar cane	Good	1,222	392	642,304	Kilos.
Corn	do	100	20	131,250	Liters.
Rice	Fair	698			
Abaca	Good		41	6,262	Kilos.
Benguet (reports from 11 municipalities):					
Rice	do	52			
Coffee	Fair	233			
Corn	Good	23			
Sugar cane	Fair	2		443	Do.
Bohol (reports from 21 municipalities):					
Rice	do	80	18,562	2,382,000	Liters.
Corn	do	330	405	445,275	Do.
Coconuts	Good			1,380,000	Nuts.
Abaca	Fair		97	19,481	Kilos.
Bulacan (reports from 11 municipalities):					
Rice	Good		10,556	44,829,000	Liters.
Sugar cane	Fair	1,095	1,930	1,429,450	Kilos.
Corn	Good	35	5	23,700	Liters.
Tobacco	Fair	25	31	23,000	Kilos.

Crops planted and harvested and condition of same taken from monthly crop reports for the month of April, 1909—Continued.

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Area.	Quantity.	Unit.
Cagayan (reports from 10 municipalities):		*Hectares.*	*Hectares.*		
Tobacco	Good		15	6,900	Kilos.
Corn	do	14	776	1,005,000	Liters.
Rice	Fair	21	280	315,000	Do.
Sugar cane	Good		67	2,846	Kilos.
Capiz (reports from 21 municipalities):					
Rice	do	2,826			
Corn	do	283	101	66,675	Liters.
Sugar cane	do	265	67	117,266	Kilos.
Tobacco	Fair	9	116	40,572	Do.
Cavite (reports from 7 municipalities):					
Sugar cane	Good	103	70	146,250	Liters.
Abaca	do				
Coconuts	Fair				
Corn	Good	5			
Cebu (reports from 28 municipalities):					
Corn	Fair	2,398	5,785	2,174,250	Do.
Tobacco	do	10	1,327	1,041,946	Kilos.
Sugar cane	Good	11	366	425,989	Do.
Rice	do	6	1,160	993,750	Liters.
Ilocos Norte (reports from 10 municipalities):					
Tobacco	Fair		339	220,754	Kilos.
Sugar cane	Good	488	1,408	153,698	Do.
Corn	do	135	69	13,125	Liters.
Maguey	do	20	100	18,975	Kilos.
Ilocos Sur (reports from 22 municipalities):					
Corn	do	86	2,117	394,350	Liters.
Sugar cane	do	322	242	486,899	Kilos.
Tobacco	do	7	292	81,282	Do.
Maguey	do	8	681	221,565	Do.
Iloilo (reports from 13 municipalities):					
Abaca	Fair		100	59,455	Do.
Tobacco	Good	5	187	31,004	Do.
Corn	do	303	208	86,625	Liters.
Sugar cane	do	119	89	145,475	Kilos.
Isabela (reports from 3 municipalities):					
Tobacco	do	20		368,000	Do.
Corn	do	1		6,750	Liters.
La Laguna (reports from 13 municipalities):					
Rice	do	1,504	2,800	480,000	Do.
Coconuts	Fair			1,722,000	Nuts.
Abaca	do		393	48,386	Kilos.
Sugar cane	do	480	430	695,750	Do.
La Union (reports from 10 municipalities):					
Tobacco	Good	90	855	508,760	Do.
Sugar cane	do	55	232	276,466	Do.
Corn	do	99			
Maguey	do		10	3,163	Do.
Lepanto-Bontoc (reports from 17 municipalities):					
Rice	Good	3			
Corn	do	238			
Tobacco	Fair		78	16,376	Do.
Sugar cane	do	31	6	16,445	Do.
Leyte (reports from 15 municipalities):					
Abaca	Good	108	4,068	823,642	Do.
Rice	do		860	968,700	Liters.
Coconuts	do			1,269,000	Nuts.
Corn	do	173	337	370,500	Liters.
Mindoro (reports from 2 municipalities):					
Sugar cane	do				
Tobacco	do		62	9,660	Kilos.
Abaca	do	1	2	380	Do.
Misamis (reports from 7 municipalities):					
Abaca	Fair	3	161	81,593	Do.
Coconuts	do			443,000	Nuts.
Corn	do	137	30	46,125	Liters.
Sugar cane	Good		8	26,565	Kilos.

Crops planted and harvested and condition of same taken from monthly crop reports for the month of April, 1909—Continued.

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Area.	Quantity.	Unit.
Moro (reports from 5 municipalities):		*Hectares.*	*Hectares.*		
Rice	Good	5			
Abaca	do		43	29,601	Kilos.
Coconuts	do			22,000	Nuts.
Sugar cane	do				
Nueva Ecija (reports from 16 municipalities):					
Sugar cane	Fair	16	36	27,830	Kilos.
Tobacco	do		66	26,450	Do.
Rice	do		4,600	9,225,000	Liters.
Corn	do	12	8	1,200	Do.
Occidental Negros (reports from 12 municipalities):					
Sugar cane	Good	1,215	1,820	2,764,025	Kilos.
Tobacco	do		1,300	508,300	Do.
Corn	do	57	455	444,750	Liters.
Coconuts	do			283,000	Nuts.
Oriental Negros (reports from 15 municipalities):					
Sugar cane	Fair	105	105	319,413	Kilos.
Coconuts	Good			424,000	Nuts.
Tobacco	do		1,501	1,039,922	Kilos.
Abaca	Fair		303	119,353	Do.
Pampanga (reports from 7 municipalities):					
Sugar cane	Good	9,375	4,190	698,913	Do.
Corn	do	73	105	82,500	Liters.
Rice	do		200	28,875	Do.
Pangasinan (reports from 28 municipalities):					
Tobacco	do	39	502	155,664	Kilos.
Corn	do	452	615	176,850	Liters.
Coconuts	do			328,000	Nuts.
Sugar cane	do	123	215	49,398	Kilos.
Rizal (reports from 15 municipalities):					
Sugar cane	do	253	90	56,293	Do.
Corn	do	224	1	3,375	Liters.
Rice	do	196	510	487,500	Do.
Samar (reports from 22 municipalities):					
Abaca	Fair	225	859	381,145	Kilos.
Corn	do	92	5	1,500	Liters.
Rice	do	58	1,774	767,400	Do.
Coconuts	do			327,000	Nuts.
Sorsogon (reports from 20 municipalities):					
Abaca	Good	104	3,456	587,656	Kilos.
Rice	do	170	3,036	1,089,450	Liters.
Tobacco	do		516	164,036	Kilos.
Corn	do	24	218	95,250	Liters.
Surigao (reports from 3 municipalities):					
Rice	do		1,200	817,500	Do.
Corn	do	18			
Tobacco	do	8			
Abaca	Fair		200	82,225	Kilos.
Tarlac (reports from 10 municipalities):					
Sugar cane	Good	292	198	157,176	Do.
Tobacco	do	10	35	19,688	Do.
Corn	do	9	18	12,525	Liters.
Rice	do	400			
Tayabas (reports from 14 municipalities):					
Coconuts	Fair			218,000	Nuts.
Rice	Good	1,100	1,626	755,850	Liters.
Abaca	do	9	364	55,597	Kilos.
Tobacco	do		40	46,092	Do.
Zambales (reports from 8 municipalities):					
Sugar cane	do	53	27	20,177	Do.
Corn	do	30	3	675	Liters.
Maguey	do		4	3,352	Kilos.
Tobacco	do		2	230	Do.

RANGE OF PRICES OF PHILIPPINE AGRICULTURAL PRODUCTS.

Highest and lowest prices of rice, abaca, copra, sugar, tobacco, and corn for the month of April, 1909.

Province.	Unhulled rice, per 75 liters.		Abaca, per 63.25 kilos.		Copra, per 63.25 kilos.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
Agusan	₱3.00	2.50	₱8.00	4.74	₱7.27	5.70
Albay	3.50	2.25	7.00	5.00	7.00	4.00
Ambos Camarines	4.00	2.00	11.00	4.40	7.50	3.50
Antique	3.00	1.50	30.00	12.00	6.00	6.00
Bataan	2.50	1.25	----------	----------	----------	----------
Batangas	3.50	2.00	8.00	7.00	----------	----------
Benguet	5.00	3.00	----------	----------	----------	----------
Bohol	4.00	2.00	13.00	5.00	9.25	6.60
Bulacan	2.80	2.00	----------	----------	----------	----------
Cagayan	4.00	3.50	----------	----------	----------	----------
Capiz	3.12	1.60	18.00	7.00	7.50	5.00
Cavite	3.00	2.25	10.00	10.00	----------	----------
Cebu	4.00	2.50	20.00	9.50	8.75	7.00
Ilocos Norte	5.00	3.25	----------	----------	5.00	2.50
Ilocos Sur	5.00	2.30	----------	----------	10.00	10.00
Iloilo	4.50	2.50	16.00	11.00	8.60	6.00
Isabela	5.00	5.00	----------	----------	----------	----------
La Laguna	3.75	2.00	17.00	5.76	7.00	5.50
La Union	2.50	2.50	----------	----------	6.00	6.00
Lepanto-Bontoc	5.00	3.75	----------	----------	----------	----------
Leyte	5.00	2.00	14.00	6.00	7.75	3.50
Misamis	3.50	2.50	9.00	6.00	7.50	6.75
Moro	3.50	2.25	10.50	8.50	7.50	7.50
Nueva Ecija	2.50	1.25	----------	----------	----------	----------
Nueva Viscaya	1.75	1.40	----------	----------	----------	----------
Occidental Negros	3.00	2.00	12.00	8.00	8.40	5.00
Oriental Negros	5.00	3.00	14.00	6.00	9.00	6.60
Pampanga	2.60	1.75	----------	----------	----------	----------
Pangasinan	5.00	2.00	----------	----------	8.00	3.00
Rizal	2.75	2.25	18.00	18.00	----------	----------
Samar	5.00	2.00	12.00	6.00	7.50	5.00
Sorsogon	3.13	2.00	12.50	4.50	6.50	3.00
Surigao	2.50	1.25	10.00	8.00	7.50	6.00
Tarlac	3.75	1.50	----------	----------	4.00	4.00
Tayabas	5.50	2.00	12.00	3.00	6.50	4.00
Zambales	4.00	1.60	----------	----------	5.00	5.00

Highestan d lowest prices of rice, abaca, copra, sugar, tobacco, and corn for the month of April, 1909—Continued.

Province.	Sugar, per 63.25 kilos.		Tobacco, per 46 kilos.		Corn, per 75 liters.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
Agusan					₱2.00	2.00
Albay	₱6.00	5.50	10.00	10.00	5.00	1.50
Ambos Camarines	5.00	3.00			4.00	1.00
Antique	4.00	3.00	25.00	6.00	2.50	1.50
Bataan	6.00	3.50			2.00	2.00
Batangas	4.30	3.00	8.00	6.00	4.00	2.00
Benguet	6.00	3.00				
Bohol	6.00	3.75	4.00	4.00	4.00	2.50
Bulacan	6.50	6.00	12.00	12.00	2.50	1.90
Cagayan	4.00	4.00	15.00	10.00	3.75	1.25
Capiz	7.00	4.00	15.00	5.50	2.50	1.00
Cavite	4.40	2.50			2.25	2.22
Cebu	5.00	2.00	30.00	3.00	4.50	2.50
Ilocos Norte	3.50	2.00	18.00	3.00	3.00	1.00
Ilocos Sur	7.00	2.00	25.00	3.50	5.00	2.00
Iloilo	6.00	4.00	18.00	5.00	3.12	2.50
Isabela			12.00	12.00	2.50	2.50
La Laguna	5.00	3.60			3.00	3.00
La Union	4.50	2.50	8.00	2.50	4.00	4.00
Lepanto-Bontoc	6.00	3.00	20.00	2.50	5.00	5.00
Leyte	7.50	4.50	25.00	15.00	4.00	1.70
Misamis	4.00	4.00	25.00	7.00	3.50	2.50
Moro					2.50	2.50
Nueva Ecija	7.50	2.50	20.00	3.00	2.50	1.00
Nueva Vizcaya					2.50	2.50
Occidental Negros	5.50	3.50	35.00	3.00	4.00	2.40
Oriental Negros	5.00	4.00	25.00	5.00	5.00	3.50
Pampanga	6.05	4.07			2.50	2.00
Pangasinan	6.40	3.00	30.00	2.00	5.00	1.50
Rizal	7.00	2.70			2.50	1.80
Samar	5.00	5.00	25.00	20.00	3.50	2.00
Sorsogon	6.75	2.50	12.00	4.00	1.60	1.50
Surigao						
Tarlac	5.70	2.50	7.50	7.00	2.50	1.20
Tayabas	6.00	3.00	8.00	6.00	5.00	3.50
Zambales	5.00	3.50	25.00	12.00	5.00	2.00

PERIODICALS IN THE LIBRARY OF THE BUREAU OF AGRICULTURE.

Everyone interested in the study of tropical agriculture is invited to visit the library and make use of these periodicals.

ENGLISH.

GENERAL.

Agricultural Bulletin of the Straits and Federated Malay States, Singapore.
The Queensland Agricultural Journal, Brisbane, Australia.
The Agricultural Gazette, Sydney, New South Wales.
Journal of the Department of Agriculture of Victoria, Melbourne, Australia.
Journal of the Department of Agriculture of Western Australia, Perth.
Bulletin of the College of Agriculture, Tokyo, Japan.
Hawaiian Forester and Agriculturist, Honolulu, Territory of Hawaii.
Tropical Agriculturist, Colombo, Ceylon.
Memoirs of the Department of Agriculture, Calcutta, India.
Natal Agricultural Journal, Pietermaritzburg, Natal, South Africa.
Agricultural News, Bridgetown, Barbados.
West Indian Bulletin, Bridgetown, Barbados.
Bulletin of the Department of Agriculture, Kingston, Jamaica.
Journal of the Board of Agriculture of British Guiana, Georgetown.
California Cultivator, Los Angeles, California.
The Rural Californian, Los Angeles, California.
Farmer and Fruit Grower, Jacksonville, Florida.
Louisiana Planter, New Orleans, Louisiana.
Southern Cultivator, Atlanta, Georgia.
Progressive Farmer, Raleigh, North Carolina.
Farmer's Guide, Huntington, Indiana.
Independent Farmer, Lincoln, Nebraska.
Kansas Farmer, Topeka, Kansas.
Farm Press, Chicago, Illinois.
The American Florist, Chicago and New York.
The Feather, Washington, D. C.
The American Thresherman, Madison, Wisconsin.
Oregon Agriculturist, Portland, Oregon.
Journal of Agriculture and Horticulture, Montreal, Canada.
The Gardeners' Chronicle, London.
Commercial America, Philadelphia, Pennsylvania.
Tropical Life, London, England.
The Breeders' Gazette, Chicago, Illinois.
The Journal of Tropical Veterinary Science, Calcutta, India.
American Veterinary Review, New York.

REPORTS AND QUOTATIONS.

Crop Reporter, by the Secretary of Agriculture, Washington, D. C.
Federal Reporter, New York, N. Y.
Smith and Schipper's Monthly Report, New York, N. Y.
Hanson and Orth, Hemp Brokers, Monthly Statement, New York.
Hemp Market Report, Landauer & Co., London.
Ide and Christie's Monthly Circular, London.
Exporters and Importers Journal, Chicago, Illinois.
Ker & Co's. Price Current, Manila, Iloilo, and Cebu, P. I.

LOCAL.

Official Gazette, Manila, P. I.
Far Eastern Review, Manila, P. I.
Philippine Journal of Science, Manila, P. I.
Weather Bureau Bulletins, Manila, P. I.
The Philippine Agricultural Review, Manila, P. I.

SPANISH.

Boletin de la Cámara de Comercio Filipina, Manila, P. I.
Boletin Oficial de la Secretaría de Agricultura, Comercio y Trabajo, Habana, Cuba.
Boletin de Agricultura, San José, Costa Rica.
Hacendado Mexicano, El, Mexico, Mexico.
Hacienda, La, Buffalo, New York.
Agricultor Peruano, El, Lima, Peru.
Prácticas Modernas é Industrias Rurales, La Coruña, Spain.
Resumen de Agricultura, Barcelona, Spain.

OTHER LANGUAGES.

Bulletin de la Chambre de Commerce de Saigon, Saigon, Indo-China.
Bulletin Economique, Hanoi-Haiphong, Indo-China.
Bulletin du Départment de l'Agriculture aux Indes Neerlandaises, Buitenzorg, Java.
L'Agronomie Tropicale, Brussels, Belgium.
Boletim de Agricultura, Sao Paolo, Brazil.
Tamil Journal of South India Agriculture, Madras, India.
Station Agronomique, Port Louis, Colony of Mauritius.
Journal d'Agriculture Tropicale, Paris.
Boletim do Museu Goeldi, Para, Brazil.

THE PUBLICATIONS OF THE BUREAU OF AGRICULTURE.

The following-named bulletins of the Bureau of Agriculture are available for distribution, and will be sent free of charge to any address upon application. Applicants are requested to state whether all publications of the Bureau are desired as issued, or only those specified. The name and address of the applicant should be plainly written and all communications should be addressed to the Director of Agriculture, Manila, Philippine Islands.

FARMERS' BULLETINS.

No. 4. Preliminary Report on Commercial Fibers of the Philippines. (Spanish.)
No. 6. Experimental Work with Fungous Diseases of Grasshoppers. (Spanish.)
No. 9. A few Suggestions on the Cultivation of Cotton. (Spanish.)
No. 11. The Jute Industry. (Spanish.)
No. 12. Abacá. (Manila Hemp.) (English.)
No. 13. The Cultivation of Maguey in the Philippine Islands. (English and Spanish.)
No. 14. The Cultivation of Sesamum in the Philippine Islands. (Spanish.)
No. 15. Tobacco Growing in the Philippines. (English and Spanish.)

PRESS BULLETINS.

No. 6. The Tamarind. (English.)
No. 8. Maguey; Propagating Abacá from Seed; etc. (English.)
No. 9. Agricultural Districts; Control of Rinderpest; etc. (English.)
No. 11. Seed Distribution; Need of Diversified Farming; etc. (English and Spanish.)

POPULAR BULLETINS.

No. 1. Maguey. (English, Spanish, Visayan, Cebuano.)
No. 2. Kapok. (English, Spanish, Tagalog, Visayan, Ilocano, Cebuano.)

PLATE I.—KAPOK ("ERIODENDRUM ANFRACTUOSUM"). COTTON TREE, PHILIPPINE ISLANDS.

THE PHILIPPINE

Agricultural Review

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EDITORIAL.

NEW FEATURES.

With this number of the REVIEW, we are introducing, or taking up again, some features which it is believed will make the magazine of greater value to the agriculturists of the Islands. Among these features are the Current Notes and the Notes from Other Fields which appear in this number.

Current notes.—The idea of the editors in giving space to current notes is to keep the readers of the magazine as fully informed as possible of the progress of the country along agricultural lines. Such items as the College of Agriculture, the College of Veterinary Science, Philippine Forests, the Beetle Pest, Reorganization of the Division of Animal Industry of the Bureau of Agriculture, Philippine Sponge Fisheries, Philippine Coals, Denatured Alcohol, and a Philippine Botanic Garden should be of interest to everyone, and, in a measure, indicate the agricultural and commercial progress which is being made in the country.

Notes from other fields.—In these notes there is no intention to discuss at length agricultural conditions in other tropical countries, except in so far as they produce the same articles and come in competition with the products of the farmers of the Philippines. Under this heading we shall endeavor to keep Filipino farmers advised as to the methods of cultivation in other tropical countries, that they may determine for themselves the best methods of cultivation and the measures that should be taken to produce the largest and best crops. We will also endeavor to advise our farmers regarding large crops or shortages in the crops of other countries which compete with them in the principal markets of the world. In short, we will endeavor to give, so far as this information can be obtained, the agricultural conditions in the principal countries raising hemp, sugar, copra, tobacco, and other agricultural staples of the Philippines—such information as will enable them to form definite conclusions regarding the supply and demand for the products of their farms. In this number attention is invited to the notes regarding rice, kapok, and ylang-ylang investigations by the government of Indo-China, the status of sugar production in the Japanese Empire, the progress of the rice and coconut industries in the Straits Settlements, the experiments by the sugar planters in Trinidad, the National Irrigation Congress at Seattle, the new products made from copra, the progress of the cacao industry in Santo Domingo, and the rubber industry in Jamaica.

Imports and exports.—By courtesy of the Collector of Customs, we expect to present in the REVIEW, each month, beginning with the September number, a tabulated statement showing the leading exports of agricultural products from these Islands, and the leading imports from other countries which are brought into the Philippines and consumed

by the people of the country. In this manner we will be able, in part, to present to the people from month to month the bills which they are paying to other countries, and the amount of money they are sending out of the Philippines for articles of food, wearing apparel, and other things used in their everyday occupations and business, which could and should be raised, made, or manufactured at home.

FARMERS COÖPERATIVE DEMONSTRATION WORK.

After a short visit in the Philippines, Prof. Albert Bushnell Hart, professor of history in Harvard University, who is a careful student of history and of peoples, prepared a statement for the Boston Transcript on conditions in the Philippines as he saw them during his stay in the Islands. Professor Hart's critical examination of the working of the Government and of the disposition and tendencies of the Filipino people are worthy of careful consideration, not only because he is a trained student of peoples, history, and political economy, but because of his careful, accurate, and farseeing statement regarding conditions here which must appeal to the intelligent and thinking natives of the country, as well as to the Americans who are conscientiously engaged with the Government in its endeavor to solve the social and political problems which fall to the lot of the people of the United States.

Professor Hart states: "It is impossible not to compare the conditions in the Philippines with those in the Southern States, where also there is a dependent race which has to take its law and government from another race." In this section of our own country we have approximately the same tropical or subtropical environment and the same resultant conditions of this environment to deal with. Not only the American negro but the uneducated Southern white man shows decidedly the influence of a tropical environment by exactly the same inclinations and traits of character which are manifested by the masses of the people, more particularly the rural population, of the Philippines. To this extent, at least, the problem of the United States Government at home in the South is substantially the same problem as that of the Insular Government of the United States in the Philippines. Therefore those of us who are endeavoring to solve the problems of the Insular Government should be able to obtain many valuable suggestions and lessons from the experience and work of our National Government in the Southern States.

In education the great need and demand is not only for the education of the masses of the people, but the greater, if not the greatest need, is for intelligent, efficient, and skilled laborers as well as citizens in the everyday callings, occupations, and business of the people who live in the South. To meet these needs and demands there has sprung up in the South, under the leadership of Gen. Samuel C. Armstrong, Booker T. Washington, and others, a large number of schools to prepare and to

help the people to fill the places which they are needed to fill in the new South. Perhaps the keynote of all the work of Booker T. Washington and those associated with him in this movement is his farseeing judgment in going at the root of the matter. He says: "With any ignorant and poverty-stricken race, I believe that the problem of bread winning should precede that of culture;" that "The whole problem of the future of the American negro hinges upon the question, *To what extent will the negro, when given a chance to help himself, make himself indispensable to the community in which he lives?*" So far there is little desire, little coöperation or effort on the part of the masses of the Filipino people toward such a regeneration and re-creation of their country. For the realization of the ideals of the Filipinos, as well as for the realization of our own success in guiding them, this indifference, inactivity and lack of coöperation must be overcome—there must be a new Philippines as well as a new South. Neither the Filipinos nor ourselves can realize the ideals for which we are both striving until there is a definite understanding of the end to be attained and coöperation toward this end for the common good. In order to secure the social regeneration or re-creation, which is the basis of the commercial and political regeneration of the country, new movements must be put in motion, other work than that at present being done by our schools must be done for the regeneration of life in the country.

Perhaps one of the movements which is accomplishing the most for the social and commercial reconstruction of the South is the farmers' coöperative demonstration work of the United States Department of Agriculture. Some time ago, we stated in an editorial that in our opinion the greatest good can be accomplished and the greatest progress made through demonstration work in every department and line of effort by the Insular Government. To any careful student of conditions in these Islands it is clear that the progress of our work is seriously handicapped by the lack of information, of touch with the outside world, of scientific progress along agricultural and other lines on the part of the Filipino people. In order to secure the coöperation of the Filipinos actual demonstrations in all lines of work are necessary. *First,* that they may understand; and *second,* that they may know, as we know, the value of our methods of procedure. Only when the Filipino people clearly understand and realize the value of our methods will we secure their active coöperation in the work which we should be doing together for the common good—for the country—a work which neither one of us can do single-handed or alone. We have spoken of the value of experiment stations, demonstration farms, and agricultural exhibitions, but there must be agencies in operation among the people which will arouse their interest and enthusiasm or these enterprises can not be a success. To meet these conditions in the South, the United States Department of Agriculture has appointed Dr. S. A. Knapp and his son,

two men who have had twenty-five years' experience with Southern agricultural problems, to take charge of this work which aims to secure the following results:

1. The emancipation of the farmer from the bondage of debt.
2. The ownership of more and better tools, teams, and stock on the farm.
3. The improvement of the land.
4. Better rural school buildings and more months of schooling.
5. Better highways, rural mail delivery, and telephone service.
6. Contentment with the life of a farmer.

With the accomplishment of the above-mentioned changes in the status of Filipino farmers it would seem that there would be little more to be desired for the re-creation of country life in the Philippines. When the Filipino farmer has been emancipated from the bondage of debt, when he has improved his lands, when the rural school buildings and schools are what they should be, when the country is supplied with modern highways, rural mail delivery and telephone service, when the life of the Filipino farmer is made such that he finds contentment and satisfaction in his business or profession, it would seem that, in a large measure at least, we will have realized the ideal—the new Philippines will then be a thing of the present.

We commend the farmers' coöperative demonstration work of the United States Department of Agriculture to the people and to the Insular Government of the United States in the Philippines. We commend the making of a large appropriation each year for the agricultural side of this work, and of a similar large appropriation by the Department of Public Instruction for the educational side of the work. We heartily commend a careful and thorough investigation of this work to the people, to our Assemblymen, and to members of the Commission as a plan for the solution of a problem in which we are making but slow progress. We have, and will have more, railroads, highways, and other public works, but these will not serve their purpose, there will be but little farm produce—little rice, sugar, hemp, and tobacco to transport—unless the people in the country, the farmers and the laborers who work on the farms, are awakened by some such agency or movement.

OUR CROP-REPORTING SERVICE.

One of the most important ways in which the farmers can coöperate with this Bureau for the improvement of agriculture in these Islands is by making a careful study of the condition of crops and live stock as required by Act No. 1898, and further outlined in the forms which are sent out by the Bureau of Agriculture. Only by actually noting from day to day the weather and the growth and development of crops under these conditions, is it possible for farmers to determine the most favorable conditions for their crops.

At present very little is known of the details pertaining to the most favorable climatic and soil conditions, and the best methods of cultivation for each of the staple crops of the Islands. If from day to day the farmers will record the climatic conditions and make note of the kind and condition of the soil at the different seasons of plant growth—namely, seeding, transplanting, flowering, maturing, and harvesting—we will be able to determine in a short time the best soils, the best climatic conditions, and the best time for planting each crop. In addition to this we ought to learn (1) the amount of each kind of seed that should be sown on a given area or planted in a hill, (2) the distance hills should be apart, (3) the number of stalks that should be placed in a hill when transplanting, (4) the best condition of the soil for transplanting, and (5) the best cultivation during the development of each plant, which taken together will produce not only the best quality of grain but the largest quantity for each crop. Only when these questions have been definitely settled for the individual farmers of the Philippines will they be able to get the best results from their farms. Then, in a measure, we will have come to the question of *intensive farming,* when farmers should more carefully study the contents and character of the soils of their farms, together with the consideration of questions as to how they may be improved by the addition of fertilizers or manures, or by the rotation of crops, and other methods which tend to conserve the strength and natural richness of soils.

In the May number of the REVIEW, in the report of the director of agriculture for the Straits Settlements and the Federated Malay States, is given a table showing the results of certain experiments in raising rice in the Malay Peninsula. In this table attention is called to (1) the date of planting in the nursery, (2) the date of transplanting in the "semillero," (3) the date of final planting in the field, (4) the average number of stalks or plants in a hill, (5) the distance between hills or "perdus," (6) the number of hills per acre, (7) the date of harvesting, (8) the amount of crop per acre in gallons, (9) the weight of the grain per acre in pounds, (10) the weight of the straw per acre in pounds, (11) the number of seeds or grains in a head. Scarcely any of these questions have been given careful consideration or thought by the average rice grower in these Islands; and yet the successful farmer must, in a measure at least, study these questions and settle each one of them for himself with reference to the varieties of rice raised in order to determine, from the sum total of his experience, what variety of rice is best for him to raise and what conditions of soil, temperature, and rainfall will enable him to obtain the largest quantity and the best quality of crop. These or similar questions may be raised with reference to every crop according to its use and value to the human family. While these questions are primarily questions for this Bureau to settle at its various experiment stations, yet the individual farmer can

not intelligently carry on his work or obtain the best results until he is able to carefully observe and to determine for himself the results of such experiments as will lead him to plant the best kinds or varieties of seed in the soil best adapted to the crop and to use the best methods of cultivation which will result in the most successful farming.

Mr. Clute, an agricultural inspector of this Bureau, while teaching agriculture in the Philippine Normal School demonstrated that corn planted, as it is ordinarily planted in the Philippines, without any thought or effort to obtain the best and largest yield—as was done in making the rice experiments in the Federated Malay States—produces for a given area $10\frac{1}{4}$ pounds of crop; that the same area if planted regularly in rows one-half meter apart and frequently cleaned and hoed will give $69\frac{3}{4}$ pounds of crop, or approximately six times as much; while the same area planted 1 meter apart, with the same cultivation, will give 99 pounds of crop, or more than nine times the average yield obtained by Filipino farmers. Coconut trees are often planted 2, 4, or 6 meters apart, but by experiment any farmer will find that trees planted 9 or 10 meters apart give a much larger yield of nuts.

These illustrations alone should be sufficient to prove to the thoughtful farmer that there is everything to be learned by careful observation and study of crop conditions, and by comparing results under different conditions, as is possible in connection with the crop-reporting service of this Bureau. Without an appreciation of the importance of this work and the enthusiastic coöperation of the farmers very little can be accomplished by the Bureau for the progress of agriculture among the people. On the other hand, if conditions are carefully studied and accurately reported, those observing and studying the effects of conditions on the different plants raised by the farmers will be surprised and wonderfully interested in what they will learn regarding the conditions for growing the best crops in the different sections of the country.

Farmers who desire to undertake some of the above-mentioned experiments, under the direction of this Bureau, for the purpose of finding out the best conditions and cultivation for the staple crops in different sections of the Islands, are invited to correspond with the Director of Agriculture.

THE NEXT INTERNATIONAL RUBBER EXHIBITION.

CHANGE OF DATE TO MAY OR JUNE, 1911.

The executive committee of the above-named exhibition has endeavored to ascertain the most suitable date for all sections of the industry. Careful inquiries showed that while the original date suited the majority, it was inconvenient to others who wished to be represented, and to whom May or June in the following year was preferable. As a result, the committee have agreed to alter the date, and take this opportunity to notify the rubber world that the next International Rubber and Allied Trades Exhibition will be held at Olympia, London, England, in May or June, 1911.

The change, it is understood, is welcome to rubber-machinery engineers who exhibited at the last exhibition, as the orders they have actually received will keep them busy for many months to come. It is therefore well to clear up the business resulting from the first exhibition before starting on the next, which will exceed its predecessor in all ways—in scope, utility, and general magnitude. Requests for further particulars should be addressed to the organizing manager, Mr. Staines Manders, 75 Chancery Lane, London, W. C., England.

FARMERS' COÖPERATIVE DEMONSTRATION WORK IN THE UNITED STATES.[1]

The farmers' coöperative demonstration work is an instance of taking education to the man on the job and luring him into the better way. It is instructing the Southern farmers by practical demonstrations on their own farms in the best methods of soil cultivation. The work is a subdivision of the United States Department of Agriculture, conducted by S. A. Knapp and his son, two men who have had twenty-five years of experience with Southern agricultural problems. It aims at these final results:

1. *The emancipation of the farmer from the bondage of debt.*
2. *The ownership of more and better tools, teams, and stock on the farm.*
3. *The improvement of the land.*
4. *Better rural school buildings and more months of schooling.*
5. *Better highways, rural mail delivery, and telephone service.*
6. *Contentment with the life of a farmer.*

A man familiar with local conditions, a practical farmer, is sent around to the farmers in his community. "Use 5 acres in the way I advise you," he says, "and I will give you the seed for nothing." The farmer complies, and cotton, say, or corn is planted and cultivated by the best modern methods.

There is a system of three sorts of agents. The local agent comes from the neighborhood in which he is going to do his work. He receives $75 a month. He drives around day by day through the different farms, makes suggestions for new methods of planting, and then returns from time to time to see that they have been carried out. He has absolutely no expenses, because he uses his own horse and team and the farmers put him up for nothing. If he were to go to a hotel he would be away from the sources of information, but when he goes right into the family he is able to convince his host of the best thing to do in planting. Over him is the district agent, who receives $100 a month and expenses. These expenses are the railway fares which he has to pay out in traveling from county to county where his local agents are at work. Over the district agent is the agent for the State, who receives from $125 to $150 a month.

[1] From Collier's, Vol. XLIII, No. 14, June 26, 1909.

This division has 325 such traveling agents. It watches their careers by a system of gaudy-headed pins as the agents make their rounds. Oftentimes a locality will vote part of the salary for its agent because it realizes the large benefits derived from his services. Sometimes a community will give $100 a month to a district agent and the division will then add $25. The United States Government gives an appropriation of $225,000 a year, and the General Education Board gives $102,000 a year.

This demonstration system began with the fight against the boll weevil of Louisiana. The campaign was then taken up in Texas, and since then has spread through Oklahoma, Arkansas, and Mississippi. Not only has it been a campaign against the Mexican boll weevil, but the other local needs of each section have received attention and the work has extended itself into Alabama, Georgia, Florida, South Carolina, North Carolina, and Virginia. These demonstrators are preaching to their localities the need of raising supplies of all sorts at home and of cultivating cotton intensively as a cash surplus by raising corn and other supplies on the same farm. The one-crop idea has been disastrous to Southern prosperity. The great central West made itself independent by raising its own supplies of every sort, instead of sticking to the one-crop idea.

HOW A KNOWLEDGE OF THE WEATHER BENEFITS THE FARMER.

(Contributed by the Weather Bureau.)

Besides, of course, the proper selection of crops suited to a given region, climate and soil are the two principal factors upon which the fruit of the farmer's toil depends. Now the climate of a place is nothing else than the combination of weather conditions so far as it affects life (both animal and vegetable), health, and comfort; hence it is evident that weather has an important bearing on agriculture, and that a knowledge of it is useful to the farmer.

Unfortunately, the problem of how and to what extent variations of climatic conditions affect animal and plant life is much more complicated than appears at first sight. Of course, every child knows that a flood, as well as prolonged drought, will kill most crops; but this does not exhaust the subject. Three different ways of solving the problem are in general use:

1. Biological investigation: The plant biologist concerns himself with the conditions and manner in which seeds germinate, the absorption of nutritive substances from the soil by the roots, the flow of the sap, the action of sunlight on the leaves, the ripening of seeds, and the nutritive value of the crops. All these functions he investigates under widely varying climatic conditions, produced artificially in the laboratory, to determine how different climates will affect the cultivation of the plants in question.

2. Experimental work: The experimental method of determining the relation between crops and climate is that practiced at agricultural experiment stations. Such institutions are quite numerous in Europe and the United States but there are few in the Philippines. The object of these institutions is chiefly to investigate the effect of natural weather upon different seeds and plants in order to ascertain the most profitable crops for a given climate; to learn whether or not desirable plants can be acclimated; and, eventually—by scientific cross-breeding and careful selection—to develop new varieties of plants which will be suited to given climates.

3. Statistics: The statistical method of ascertaining the effect of climate upon crops consists in compiling and comparing statistics of

successive crops and of the weather which prevailed during the respective seasons. Though this empirical method is far from being perfect and at most only shows us what has happened under certain conditions without letting us know, except in a general way, the "why" thereof, still it is of great practical value and is in fact the only method directly useful to the farmer. After all, the agriculturist cares very little for the "why," provided his granary is overflowing; and in case of a failure of crops in consequence of a drought it would presumably be small consolation to him to know to a milligram the amount of water per square centimeter of leaf surface which must be supplied to a specified plant every twenty-four hours to enable it to flourish with the thermometer registering 35° C. This remark does not imply that the work of the scientific investigator and the experimentalist are not of the greatest importance to agriculture; on the contrary it is devoutly to be wished that circumstances may permit of vastly extending both laboratory and experimental farm work in these Islands. It is only asserted that their results do not affect the husbandman who has crops growing in the field so immediately as do those of the statistical method.

Ever since its establishment in 1865, the Manila Observatory has collected weather statistics of the Philippine Islands. Progress has been slow, nevertheless the accompanying list shows 26 stations which furnished weather records prior to 1898. Thanks to the Weather Bureau, established by the Philippine Government in 1901, a fair amount of weather statistics has been gathered. In the list given below are shown all the stations at which any meteorological observations have been made for a period of two or more years. This list needs no explanation; it is sufficient to state that only the principal crops of each region have been mentioned. The letters "Cont." in the column headed "End." signify that the respective stations are still in operation.

Meteorological stations in the Philippines, 1865–1909.

Province and island.	Station.		Crops.	Period of observations.			Remarks.
	Town.	Class.		Beginning.	End.	Years.	
Moro:							
Jolo	Jolo	V., III	Miscellaneous	1894	Cont.	12	Interrupted, 1898–1902.
Basilan	Isabela	IV	Sugar, coffee, corn	1903	Cont.	6	
Mindanao	Zamboanga	V., I, III	Rice, copra, hemp	1894	Cont.	9	Interrupted repeatedly.
	Mati	V	Hemp	1897	1898	2	
	Davao	V., III	Rice, hemp	1895	Cont.	11	Interrupted, 1898–1901.
	Tamontaca	V	Sugar, rice	1894	1896	3	
	Cotabato	V., III	Sugar, rice	1895	Cont.	10	Interrupted, 1898–1902.
	Caraga	III	Hemp, tobacco	1903	1907	5	
	Dapitan	V., III, IV	Hemp, rice	1893	Cont.	12	Interrupted, 1898–1902.
	Balingasag	III	Hemp, rice	1902	1907	6	Many months missing.
Agusan, Mindanao	Butuan	III	Hemp	1903	Cont.	6	
Surigao, Mindanao	Tandag	V	Hemp	1896	1898	3	
Bohol	Tagbilaran	II	Rice, corn	1902	Cont.	7	
Surigao, Mindanao	Surigao	II	Hemp	1902	Cont.	7	
Leyte	Maasin	II, III	Hemp	1902	Cont.	7	
Cebu	Cebu	A. S., I	Rice, sugar	1878	Cont.	13	Interrupted repeatedly.
Occidental Negros	La Carlota	A. S	Rice, sugar	1889	1897	9	
	Bacolod	III	Rice, sugar	1902	1908	7	
Iloilo, Panay	Iloilo	A. S., I	Sugar, rice	1894	Cont.	11	Interrupted, 1896–1901.
Antique, Panay	San José	III	Rice, corn	1902	Cont.	7	
Cebu	Tuburan	III	Hemp, sugar	1902	Cont.	7	
Palawan, Cuyo	Cuyo	IV	Miscellaneous	1891	Cont.	9	Interrupted several years.
Leyte	Ormoc	I	Hemp	1902	Cont.	7	
	Tacloban	II	Hemp	1904	Cont.	5	
Capiz, Panay	Capiz	II	Rice, copra	1902	Cont.	7	
Samar	Barongan	IV	Hemp, copra	1903	Cont.	6	
	Catbalogan	V	Hemp, rice	1904	Cont.	5	
Palawan, Culion	Culion	V	Miscellaneous	1906	Cont.	3	
Samar	Calbayog	V., III, II	Hemp, rice	1890	Cont.	19	
Masbate	Palanoc	IV	Copra	1904	Cont.	5	
Romblon	Romblon	III	Copra, hemp, rice, tobacco	1903	Cont.	6	
Samar	Laoang	III	Hemp	1906	Cont.	3	
Sorsogon, Luzon	Gubat	III	Hemp	1903	Cont.	6	
Albay, Luzon	Legaspi-Albay	I	Hemp	1891	Cont.	15	Interrupted, 1898–1902.
Albay, Luzon	Tabaco	Sp	Hemp	1890	1898	9	
Mindoro	Mamburao	V	Rice, copra	1896	1899	4	Many months missing.
	Calapan	III	Rice	1907	Cont.	2	
Camarines, Luzon	Nueva Caceres	Sp., III	Rice, hemp	1887	Cont.	8	Interrupted, 1888–1902.

Meteorological stations in the Philippines, 1865–1909—Continued.

Province and island.	Station.		Crops.	Period of observations.			Remarks.
	Town.	Class.		Beginning.	End.	Years.	
Batangas, Luzon	Batangas	III	Rice	1907	Cont.	2	
	Cape Santiago	Sp	Miscellaneous	1886	1898	12	
Tayabas, Luzon	Atimonan	Sp., I	Rice, hemp, copra	1886	Cont.	19	Interrupted, 1898–1902.
	Tayabas	Sp	Copra, rice	1885	1897	13	
Camarines, Luzon	Daet	Sp., II	Rice, hemp	1886	1904	15	Interrupted, 1897–1902.
Cavite, Luzon	Lilang	IV	Rice, hemp	1904	Cont.	5	
	Restinga Point	Sp	Miscellaneous	1885	1895	12	
La Laguna, Luzon	Biñan	III	Rice, copra	1903	1904	2	
	San Antonio	IV	Rice, hemp, copra	1904	Cont.	5	
Cavite:							
Corregidor	Corregidor	III	Miscellaneous	1903	1908	5	
Luzon	Cavite	III	Miscellaneous	1903	1904	3	
	Manila	Sp. (central observatory).	Rice	1865	Cont.	44	
Bataan, Luzon	Balanga	IV	Rice, sugar	1903	1908	5	
Bulacan, Luzon	Marilao	III	Rice	1902	1906	4	
Zambales, Luzon	Olongapo	II	Rice	1902	Cont.	7	
Pampanga, Luzon	Porac	IV	Sugar, rice	1903	1906	4	
	Arayat	III	Rice, sugar	1902	1906	5	
	Magalang	A. S.	Rice	1894	1897	4	
Zambales, Luzon	Iba	III	Rice	1902	1903	2	
Nueva Ecija, Luzon	San Isidro	Sp., II	Rice	1888	Cont.	17	Interrupted, 1898–1902.
Tarlac, Luzon	Tarlac	III	Rice, sugar	1902	Cont.	7	
Zambales, Luzon	Masinloc	III	Rice	1903	1905	3	
Tayabas, Luzon	Baler	IV	Miscellaneous	1902	Cont.	7	Few months missing.
Pangasinan, Luzon	Dagupan	I	Rice	1902	Cont.	7	
	Bolinao	Sp., III, II	Rice	1886	Cont.	18	Interrupted, 1898–1902.
Benguet, Luzon	Baguio	I, III, I	Miscellaneous	1900	Cont.	9	
Nueva Vizcaya, Luzon	Bayombong	Sp	Rice	1886	1897	12	
Union, Luzon	San Fernando	III	Tobacco, rice	1902	Cont.	7	
Nueva Vizcaya, Luzon	Echague	III	Tobacco	1907	Cont.	2	
Ilocos Sur, Luzon	Candon	III, IV	Miscellaneous	1902	Cont.	7	
	Vigan	Sp., II	Miscellaneous	1887	Cont.	16	Interrupted, 1896–1902.
Cagayan, Luzon	Tuguegarao	Sp., III, II	Tobacco	1881	Cont.	8	Interrupted many years.
Ilocos Norte, Luzon	Laoag	Sp., III	Tobacco	1886	Cont.	14	Interrupted, 1897–1906.
Cagayan, Luzon	Aparri	Sp. I	Tobacco	1886	Cont.	14	Interrupted, 1896–1902.
Batanes, Batan	Santo Domingo	II, III	Miscellaneous	1902	Cont.	7	

REMARKS.—I. In the third column, "Class" refers to the new organization of the Weather Bureau in May 1901. "V." means volunteer observer. "Sp." means that the place was a regular station of the Spanish "Servicio Meteorológico de Filipinas." "A. S." means agronomical station. Many abbreviations applied to the same station mean that the place has been successively working on different capacities.

II. Beside the stations above mentioned there are others in which meteorological observations were conducted by volunteer observers for one or, at most, two years, as, for instance, Polloc, Gigaquit, Tandac, Sigaboy, etc., in Mindanao, and some others in Luzon. These observations are published in the Boletin Meteorológico of the Manila Observatory, and correspond to the epoch 1890–1898.

In discussing the benefits to be derived by the agricultural population from a knowledge of the weather we must distinguish between normal and actual weather. The *normal* weather of a place (which is almost though not quite synonymous with climate), as it is usually called, is the average weather deduced from a series of observations covering several years. In the tropics a period of five years is generally sufficient to give a fair approximation. What *actual* weather means is clear. It must not be confused with abnormal weather; the latter designation is to be applied only when the departure from the normal or average conditions is considerable.

Now, even to the scientific investigator in his laboratory and to the expert in charge of an experimental farm, a knowledge of the climatic conditions under which his results are to be applied to practical agriculture is very necessary. Otherwise his labors may increase our theoretical knowledge, but will not benefit the farmer out of whose taxes the expenses of the investigation are defrayed.

As regards the direct benefits to be derived by the agriculturist from a knowledge of the weather, it is surely not less becoming to the farmer than to people in other walks of life to know something about the forces which affect his personal welfare; moreover, although he can not control the meteorological elements which make up climate, he can, in many instances, profit by accommodating himself to them. If free to choose, a knowledge of the normal weather of a region will tell him what soil will be preferable and he will not undertake to bring lands under cultivation which give no hope of success. If bound to a certain farm, his knowledge of the normal conditions is likely to give the best returns for his exertions. It was due in great part to a complete disregard of such conditions that in certain parts of the Island of Cebu people persisted in planting rice, though the normal rainfall showed clearly that the crop could succeed only by accident.

A knowledge of the normal weather conditions becomes very important when there is question of attempting to control the only climatic element which can be controlled, or, more properly speaking, supplemented to a certain extent; that is, the supplying of the requisite amount of water by irrigation works. It would evidently be foolish to construct such works in regions in which the total water supply available is inadequate for the purposes of raising crops. Even where there is no doubt of this sufficiency, the irrigation engineer will have to be guided by weather statistics, showing not only the amount, but also the distribution of precipitation, etc., lest his work prove either of too small capacity to meet the demands, or be unnecessarily large and costly.

A knowledge of the actual weather prevailing over extended regions is not of great utility to the farmer in the tropics. In the United States hundreds of thousands, if not millions, of dollars are occasionally saved to the farming community in a single year by timely warnings against

approaching cold waves. This danger does not threaten the Philippine farmer, and against the one which actually menaces him, the devastating typhoon, he is utterly helpless. Still, information regarding the current weather in different parts of the Archipelago may be of some use to him, since it will enable him to forecast the abundance or scarcity of the more important crops and consequently the conditions of the market.

At the request of the Bureau of Agriculture, the Weather Bureau has undertaken to furnish henceforth, two weeks after the close of each month, a summary of the meteorological elements which most directly affect crops, for insertion in THE PHILIPPINE AGRICULTURAL REVIEW.

The stations selected represent the average weather of the districts in which the most important products of the Philippines are raised: thus Tacloban and Albay represent the hemp district, the sugar and rice districts are represented, respectively, by Iloilo and Tarlac, while the tobacco region is represented by San Fernando (Union) and Aparri. More typical places could, no doubt, be found than those selected, but they either have no meteorological stations, like Bacolod, Negros, or the postal facilities or other difficulties, are such as to preclude the possibility of getting the reports in time for publication.

KAPOK.

(*Eriodendron anfractuosum.*)

By Sam. H. Sherard, *Agricultural Inspector.*

Botany.—The kapok is a tall tree with a straight trunk, prickly when young, with whorls of horizontal branches palmately compound, deciduous leaves, and flowers appearing before the leaves, followed by pods containing the silky floss.

The flowers are dirty white with a staminal tube splitting into five portions, each with two anthers. The corolla is five-lobed with petals joined near the ovary. The petals are of a creamy color, covered with a minute hair-like growth and are about one-half inch in length, one-fourth inch in width at the center, and taper to a point at the terminal end. The stamens are in five bundles with filaments joined at the base, each bearing versatile anfractuose anthers; the style is crowned with a five- or six-cleft stigma. The pollen is discharged through longitudinal slits in the anther cells.

The leaflets vary in number from five to nine, though seven is the usual number found in the Philippines. They are lanceolate, cuspidate, entire or surratate toward the point; the petioles are as long or longer than the leaflets, the stipules small and deciduous. The capsule is cucumber-shaped, woody when mature, five-celled, five-valved, cells many-seeded, with seeds embedded in the flossy down.

The receptacle is club-shaped, and the floral organs rise from it in successive sets.

Distribution.—The kapok tree is found throughout the provinces generally, though it is only cultivated to a small extent in and around the barrios and towns, at which places the trees are used for fence posts and telephone poles, while the fiber is used for stuffing pillows and cushions. It is also used in upholstery. The floss is brittle, elastic and very inflammable, and it is usually about 1 to $1\frac{1}{2}$ centimeters in length. It is too short for spinning purposes. "Its elasticity and harshness prevent its becoming matted, as in the case with Sinal floss," says Doctor Warden, "and therefore it is considerably superior to that fiber."

In the cultivated state, or when the trees are used for fence posts, they

PLATE II.—LEAF, FLOWER, AND YOUNG PODS OF KAPOK.

are from 1 to 20 feet apart. The flowers, as a usual thing, begin to open in December, though they vary in different provinces. Blooms have been noticed by the writer in March. He has also seen blooms, buds, young and old pods on the same tree at the same time.

The number of pods on a tree varies according to whether the tree has been topped or not, and as to whether the enemy of the fruit buds has eaten them or not. A tree 15 inches in diameter has from thirty to one hundred and thirty pods.

The pods begin to ripen about the first of April. At this time they are taken from the trees as they ripen, opened by hand, and the fiber dried in the sunshine. Then a small quantity of the floss is put into an earthen jar. Into the jar containing the fiber is placed a stick about 1 meter long, with a piece nailed across the lower end to form a cross. The handle of this stick is taken between the palms of a man's hands and by moving the palms forward and backward the stick is made to revolve and thereby the seeds are separated from the floss or fiber.

The seeds of the kapok tree have been made into cakes and the comparative value of these cakes and ordinary cotton-seed cake for cattle feeding purposes has formed the subject of an inquiry by Mr. Reinders and the following analytical results were obtained:

Constituent.	Kapok cake (per cent).	Cotton-seed cake (per cent).
Water	13.28	12.00
Albuminoids	26.34	20.62
Fat	5.82	6.36
Non-nitrogenous compounds	19.92	35.42
Woody fiber	28.12	20.36
Ash	6.52	5.64

The ash of the kapok seeds contains 28.5 per cent of H_3PO_4 and 24.6 per cent K_2O. They also contain an oil which is edible.

Doctor Cooke of India has the following to say about the gum of kapok: "The gum is said to be astringent and is used medicinally in bowel complaints." He also says: "The wood is very bright and soft; it is used in tanning leather and sometimes it is hollowed out and used for canoes. An inferior reddish fiber is prepared from the bark which is used for making paper and ropes."

The only enemy of kapok is the "fruit bat." This animal attacks and eats the young buds. There is no specific remedy, but the natives place a bell in the tree and attach a string to it; by means of this string they ring the bell and scare the bats.

The fiber from 100 average size pods weighs 3 pounds 11 ounces. One hundred pods are sold for 25 centavos.

Kapok statistics.

No. of tree.	Diameter (inches).	Height (feet).	Age (years).	Date of flowering.	Number of pods.	Topped or not.	Cultivated.
1	3	12	1½	December–March	4	No	No.
2	3½	15	2	do	14	No	No.
3	15	50	15	do	79	Yes	Post.
4	17	50	16	do	80	Yes	Post.
5	15	40	15	do	45	Yes	Post.
6	16	40	15	do	29	Yes	Post.
7	6	25	5	do	23	Yes	Post.
8	15	40	15	do	67	Yes	Post.
9	10	30	10	do	20	Yes	Post.
10	15	40	15	do	65	Yes	Post.
11	15	40	15	do	30	Yes	Post.
12	14	35	14	do	25	Yes	Post.
13	14	35	14	do	15	Yes	Post.
14	18	50	17	do	30	Yes	Post.
15	13	25	12	do	26	Yes	Post.
16	16	45	16	do	30	Yes	Post.
17	6	25	5	do	37	No	Post.
18	7	20	6	do	65	Yes	Post.
19	15	40	15	do	29	Yes	Post.
20	8	40	7	do	80	Yes	Post.
21	14	50	14	do	130	Yes	Post.
22	10	40	10	do	35	Yes	Post.
23	11	40	10	do	45	Yes	Post.
24	7	40	6	do	20	No	Post.
25	10	40	10	do	70	Yes	Post.

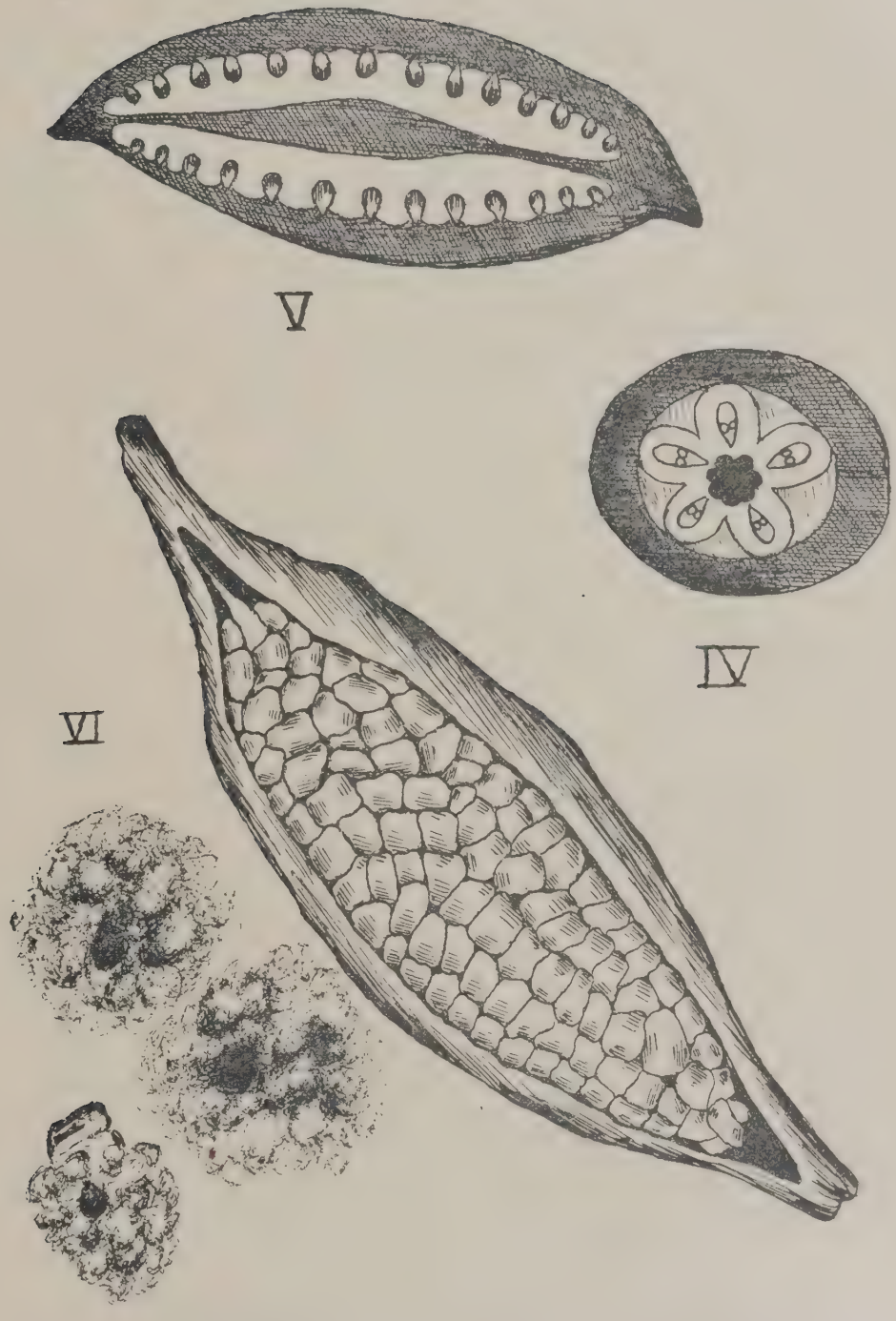

PLATE III.—CROSS SECTION AND LONGITUDINAL SECTION OF PODS, OPENED POD, AND FLOSS OF KAPOK.

EXPORTS OF KAPOK FROM DUTCH EAST INDIES, 1904 TO 1907.[1]

[In kilograms.]

	1904.	1905.	1906.	1907.
Exports to—				
Netherlands	2,684,114	2,603,752	2,246,500	3,703,745
England	5,443	20,130	87,338	64,187
France	17,689	56,196	142,865	308,864
Germany		2,457	9,634	14,489
Denmark			2,126	2,703
Italy	6,155	26,249	24,902	23,243
Spain				1,061
Port Said			20,013	14,577
America	606,558	1,514,376	1,275,700	1,445,829
English Indies			52,315	38
Penang	51,515	32,352	29,406	29,120
Singapore	817,687	823,898	517,572	631,795
Hongkong	121,790	10,227	103,245	36,479
China	2,616	2,233	27,175	1,000
Japan		96,134	7,194	1,002
Australia	976,186	1,697,500	1,676,069	2,638,648
Other places	328	1,074	34,897	
Total	5,290,090	6,886,578	6,256,951	8,916,780
Exports from—				
Batavia, Java				395,125
Cheribon, Java				315,198
Tegal, Java				131,606
Semarang, Java				4,674,170
Sourabaya, Java				2,832,105
Makassar, Celebes				213,251
Palembang, Sumatra				203,441
Other ports				151,884
Total				8,916,780

[1] From the Statistics of Trade, Navigation, and Commerce for the Dutch East Indies, by courtesy of P. K. A. Meerkamp, consul for the Netherlands.

SOME OBSERVATIONS ON THE RAT PEST.

By David B. Mackie, *Agricultural Inspector.*

Probably the greatest pest that is infesting the country in general, and on which an almost universal warfare is being waged, is the rat. Of all mammalian pests it is the most insatiable. The damage to crops through its agency amounts in some European countries to over ₱20,000,000 annually.

As carriers of disease rats are far more dangerous than as destroyers of crops. The health department of India has invariably traced to the rat the cause of bubonic plague which annually claims so many victims in that country. The agency by which the disease is carried from the rat to the human being is rat fleas (*Pulex cheopsis*), which thickly infest the rat's fur; as these parasites flourish on human blood one can readily see how a rat that has been contaminated by plague germs can easily spread the disease to man.

In the United States the significance of rats as a pest has only lately been realized, but it has reached a stage where legislation has been secured to suppress them, and the Government has published bulletins containing formulas for poisons said to be effective in destroying them.

In Europe and Asia, the original habitat of the rat and where it has remained undisturbed for centuries, the number has increased to such huge proportions that it has become necessary to organize special societies for its suppression and to secure the financial and active aid of the respective governments.

During the past few years the agricultural journals of the Federated Malay States, India, Ceylon, Java, and other islands have reported considerable damage to rice and other cereal crops by this pest. Of late reports have reached this Bureau that in these Islands considerable damage is being done in many provinces to the rice crop through the same agency. Judging from the reports received by the Bureau, the provinces of southern Luzon and the adjacent islands seem to be more widely infested than other sections, although reports have been received from the Province of Bataan and the Islands of Panay and Negros.

SPECIES.

In the latter part of January of this year the writer was detailed by the Director of Agriculture to study the habits of the rodents, also those of any other pests of the rice crop, and if possible ascertain some method of exterminating them. In connection with the work the

Provinces of La Laguna, Albay, Sorsogon, and the Catanduanes Islands, a subprovince of Albay, were visited. The greatest damage in the majority of cases may be attributed to a large gray rat which closely resembles the common brown rat, *Mus norwegicus,* and is probably that species. Specimens of this species were secured in every barrio and municipality of the three provinces visited. Specimens of three other species were secured, but I found them extremely rare and I do not believe that they occur in sufficient numbers to materially affect the crops.

OTHER PESTS.

Before taking up the methods of extermination it might be well to state that in some cases the damage that is attributed to rats is the work of other pests.

Month larvæ.—I visited the municipality of Bacon in Sorsogon Province from which reports of damage by rats had been received. On investigation a large percentage of the damage was found to be the work of the larvæ of a certain moth. The eggs of this species are deposited on the stalk about 2 inches from its base. As these hatch the nymph eats in the stem and takes up its abode, working its way upward and eating as it goes. Upon arriving at maturity it eats its way out, leaving a ragged hole which causes the stalk to fall and gives one the impression that it is the work of rats.

Ducks.—Wild ducks, principally the Luzon mallard (*Anas luzonica*) and another small brown duck (*Dendrocygna arcuata*) do considerable damage in such a way that it might, by an inexperienced person, be misunderstood and charged to the rat. They alight in large numbers in the fields and lay the rice flat in certain areas, thus giving one the impression that it is the work of rats.

Birds.—Rice finches (*Munica jagori, Urolonca everetti,* and *Munia oryzivora*), which are very common in some districts, do considerable damage, but the people never confuse their work with that of the rat, as they alight on the stems and strip the heads without breaking the stalk.

LIFE HISTORY.

A very imperfect knowledge of the habits and life history of the rats has proven a great hindrance to the work of extermination, to say nothing of the lack of interest displayed by certain persons who should be most interested. As a result of our investigations for the past five months in the two most heavily infested provinces, we have now secured considerable data pertaining to the life history of rats.

During the rainy season most of the rats live in the mountains, although some spend that period in houses. As the paddies dry out the rats descend from the mountains in immense numbers and, separating into small communities, begin operations. At this time the crop is

beginning to ripen and the grain is in the milk. The stems of the plants are gnawed at a distance of about 4 or 5 inches from the base and then pulled down by the rats. In their workings they do not cut off the stalks in definite areas, but work inward, extending their runways and cutting off the plants on both sides as they advance, making paths of considerable length, running in no definite direction. On close observation it is generally found that the main paths start from some more elevated section or other favorable location.

At this season they also breed. The nests are generally located in a hollow post, a bamboo thicket, or some pile of débris. They are ramshackle affairs composed of a few leaves and perhaps a few blades of grass. Here the young are brought forth. When first born they are helpless, being blind and hairless, measuring 35 millimeters in length. In about eight or ten days the eyes open and they are able to walk a little, but they generally stay in or in close proximity to the nest for about a month, although I have seen specimens in their nests which were much older.

In the common species the number of young brought forth at a time varies from three to eight. The average number is from four to six. Mature rats are very prolific, generally breeding three or four times a year. As they begin to reproduce when three months old, it will readily be seen that the progeny of one pair, if left undisturbed, would in a single year amount to about 1,000 individuals.

The other three species, as previously stated, are rare and I have had no opportunity to work out their life histories. An adult male specimen of the small brown variety taken in Viga, Catanduanes, measured 240 millimeters total length, the body being 110 millimeters and the tail 130 millimeters. Another specimen taken at Bagamanoc was a small gray rat with white under parts. It was an adult pregnant female and contained six fetuses. This specimen measured 220 millimeters, the body measuring 105 millimeters and the tail 115 millimeters.

METHODS OF EXTERMINATION.

Regarding the possibility of exterminating rats, I will say that it is not a task that can be handled by one man and finished in a season. It will require the coöperation of the municipal presidents and *tenientes* of the barrios as well as of the entire population of the infested areas.

Time for operations.—From the time that the rice crop is harvested until the commencement of the rainy season would seem to be the best time to deal with this pest. This season has two great advantages. *First,* the rats are in the fields in large numbers and they are breeding; their food supply is quickly cut off and they are left starving. This fact was established by investigations in the barrio of Bagamanoc, Catanduanes, Albay Province. In this province, where the rats were very prevalent, twelve traps were set every night. Each morning the traps

were collected and the contents examined. The catch varied from 80 to 100 per cent of the possible. Generally we caught ten rats for every twelve traps set. The rats trapped were in turn eaten by other rats. This fact goes to show that the rats were sorely pressed by hunger when they resorted to cannibalism. *Second,* climatic conditions are most favorable at this time as the paddies are dry, and as there is little rain falling the baits do not become disintegrated by the action of the water.

The methods of destroying rats are many and diverse. They vary from the old-fashioned rat trap to bacterial cultures. One method which I think worthy of consideration involves the reversing of a biological law. It might be practicable in these Islands, but I think it would prove rather expensive. The agent by which this reversion could be brought about is a trap that will catch the rodents alive. Scientific experiments show that a larger percentage of males are trapped than females. Thus the tendency of the remaining males would be toward polygamy. In polygamy the tendency of the females is to produce a large percentage of female offspring. Thus in a short while the pest would gain by the increased number of females what it had lost by trapping or poisoning. By reversing this condition, which could be done by releasing all captured males and killing all the females, polyandry would necessarily result. Where there is a superabundance of males, the tendency is to kill off the young and to worry the females. It would be no great time until the males killed off all the females and eventually they would exterminate themselves.

Viruses.—Of the different viruses those prepared by Danysz, of the Pasteur Institute of Paris, and Newman, of Arlborg, Germany, are the most notable.

The Danysz culture is the outcome of extensive investigation and experimental work which was made possible by a spontaneous outbreak of disease among the field mice in France. Doctor Danysz investigated the epidemic and after prolonged research succeeded in finding the cause, the germ *Cous bacillus.* By dint of continued effort and perseverance he ultimately isolated the microbe. Moreover, he cultivated it and obtained cultures in sufficient quantities to meet commercial demands. This virus acts upon the digestive organs. It sets up a violent intestinal irritation similar in its diagnosis to virulent typhoid fever. The disease is highly contagious and is quickly disseminated. In some cases older rats which were of robust constitution were able to withstand the first effects of the disease and became, as it were, inoculated, rendering themselves proof against the microbe.

The Newman virus which acts in the same way as that prepared by Doctor Danysz—that is, upon the intestines—was also obtained after very extensive investigation. The first bacteria to be isolated were obtained from the urine of a two-year old child.

Poisons.—In the Journal of Agriculture for the Federated Malay States carbon bisulphide is mentioned as a chemical which has been used successfully in reducing the rats in that country. The method most commonly used is to investigate the land that is occupied by the rats and find all of their holes in the ground. Into these holes is placed a small quantity of carbon bisulphide. This chemical is very volatile and quickly transforms into a heavy poisonous gas that permeates the entire atmosphere and generally kills every living organism with which it comes in contact. This latter method may be of use in the Philippines, but as yet I have been able to find but few places where the rats live in holes in the ground. The great majority of them live, as before mentioned, in thickets, hollow logs, and débris piles; this is doubtless on account of the wetness of the rice fields. Should we at a later date find the rats living in holes this method will undoubtedly furnish the easiest and most economical way of reducing them. Other compositions received from different parts of the world have been tried and found to be unpalatable to the rats, as they will not eat them.

This Bureau has lately received a prescription from British India which is highly recommended by the inspector-general of the civil hospitals of that country. We are also awaiting the receipt of other formulas from the department of agriculture of Western Australia which have been successfully used against the rabbits in that State. The following is the Indian formula:

Yellow phosphorous, 15.0 kilos, at ₱7.50	₱112.50
Carbon bisulphide, 12.0 kilos, at 88 centavos	10.56
Lard oil or lard, 28.5 kilos, at 40 centavos	11.40
Brown sugar, 35 kilos at 22 centavos	7.70
Flour, 71.5 kilos, at 15 centavos	10.72
Flavoring essences, 5 kilos, at ₱5	25.00
Lamp black, 3.5 kilos, at 30 centavos	1.05
Ghi or butter, 60 kilos, at 88 centavos	52.80

On investigation I find that the ingredients for the above-mentioned composition can be secured in Manila in sufficient quantities to admit of the manufacture of the article for commercial purposes. The Bureau of Science has already undertaken the task of mixing several sample lots of this and other similar compositions. By the middle of August we expect to be again at work in the field and make a test regarding the efficiency of these preparations as rat exterminators, and we have reason to believe that some of them at least will be successful.

THE CROP-REPORTING SERVICE.

By W. D. Hobart, *Division of Statistics.*

A law passed by the Philippine Legislature at the last session providing for the preparation by municipal presidents of quarterly reports on crop and live-stock conditions in their municipalities is considered so important that it is quoted in full, as follows:

Act No. 1898.—An Act providing that municipal presidents shall make special quarterly reports on the condition of agriculture, live stock, and on other matters in their respective municipalities.

By authority of the United States, be it enacted by the Philippine Legislature, that:

Section 1. The presidents of the municipalities created in accordance with Act Numbered Eighty-two shall make quarterly reports of the condition of agriculture and live stock in their respective municipalities, and of such other matters as relate to their development, based upon the following particulars:

(*a*) Whether any kind of crop has been damaged by excessive rain, drought, or wind, and upon what date;

(*b*) Whether any crop has been damaged by insects such as locusts, and so forth, or by reason of any disease, and when;

(*c*) The names of the five most important crops grown in the municipality;

(*d*) The names of some of the crops of lesser importance grown in the municipality;

(*e*) Condition of live stock: (1) number of horses, cattle, carabaos, hogs, goats, and sheep; (2) increase during the quarter; (3) decrease during the quarter; (4) number of cases of disease; (5) number of deaths; (6) nature of the disease; and (7) remarks.

(*f*) (1) The total number of hectares sown prior to the beginning of the quarter, with the following products: palay, hemp, maguey, cocoanuts (number of trees), sugar cane, tobacco, maize, coffee, and cacao; (2) the hectares sown during the quarter with the said plants; (3) the state or condition of the crops; (4) the number of hectares which were productive during the quarter (for cocoanut trees, the number of cocoanuts); (5) the total quantity harvested during the quarter; (6) the average production per hectare (for cocoanuts, the quantity of cocoanuts to the tree); (7) the quantity of such products then remaining in the possession of the owners of the crops and local dealers, according to the measurement and weight specified in the fifth number of this paragraph; (8) the value, at the date of the report, of each one of the said products, according to the measurement and weight specified; and (9) remarks.

Sec. 2. The report so made shall be submitted to the municipal council, and, if approved, a copy thereof shall be forwarded to the office of the provincial

governor, a second copy to the Delegate from the district, a third copy to the Bureau of Agriculture, which shall furnish the necessary blank forms, and a fourth copy shall be filed in the office of the municipal secretary.

SEC. 3. The Bureau of Agriculture shall make a summary of the reports received from the municipalities, as provided in this Act, which shall be incorporated in the monthly review published by the said Bureau.

SEC. 4. This Act shall take effect on its passage.

Enacted, May 17, 1909.

It will be seen that the Bureau of Agriculture is to furnish the blank forms to be used; and from the reports it receives from all of the municipalities is to make a summary which will be published in the PHILIPPINE AGRICULTURAL REVIEW.

Since the inauguration of the crop-reporting service in these Islands, for which funds were made available for expenditure by this Bureau three years ago, monthly reports have been received from voluntary correspondents. Approximately one-half of these correspondents have been municipal presidents and one-half private individuals. Many of the correspondents have taken great pains to make their reports as accurate as possible and deserve the thanks of all. Others, however, have not given the attention to the work which such an important matter deserves.

The new law, it will be seen, originated in the Philippine Assembly and shows how important that representative body, with their knowledge of conditions all over the Islands, considered the preparation of accurate statistics of crops and live stock. They believed the best results could be obtained by putting this work into the hands of municipal presidents.

It is confidently expected by this Bureau that the change of reports from monthly to quarterly, which gives more time for their preparation, will result in greater accuracy. Another advantage over the former system is that presidents will be able to obtain the coöperation of the councilors, *tenientes* of barrios, and, it is hoped, the continued service of those private individuals who have heretofore done such good work on the reports which were formerly made direct to this Bureau.

As it is believed that the Bureau should always be in touch with municipal officials and familiar with the general conditions of crops and live stock, a form has been prepared and will be sent to all municipal presidents covering the first two months of each quarter, asking for general information as to whether crops have been damaged from any unusual cause, the general condition of growing crops, local prices, and cases of sickness and death of farm animals.

In conclusion, correct agricultural statistics have an importance which is universally recognized. If municipal officials and all who realize the great benefits to be derived from them will heartily coöperate with municipal presidents, whose reports are the basis of the statistics to be made up by this Bureau, the whole country will be the gainer. In no

other way than by prompt and accurate reports on the condition of crops and live stock can the Government and the farmers coöperate for the immediate suppression of the enemies of our staple crops. By means of such reports we may all learn little by little those conditions under which the largest and best crops can be produced on a given area of land. Only when the farmers and municipal officials become interested and enthusiastic—in fact, serious—regarding this matter can the Government and the people of these Islands make any considerable progress in agricultural development.

THE TENSILE STRENGTH OF MACHINE AND HAND STRIPPED ABACA FIBER.[1]

By Raymond F. Bacon.

Promoters of hemp-stripping machines have from time to time maintained that the hand-stripped fiber is not so strong as machine-stripped hemp. It is of considerable importance to the Manila hemp industry to substantiate these claims, as there seems to be little doubt that in a few years a large part of the abaca leaves will be stripped by machines, and if the machine-stripped hemp is stronger than the hand-stripped variety, the whole Manila hemp industry will be very materially benefited. The present active competition which Manila hemp must meet with the sisal and maguey fibers is largely due to the fact that these latter are machine-stripped, and consequently more uniform and stronger than retted or hand-stripped fibers of the same species.

I have made tests on the comparative tensile strength of machine and hand-stripped abaca fibers. In the first series of tests, stalks from the same plantation of the same age were selected at random, one-half were stripped on the machine and one-half by hand. The latter represented the best grade of hand-stripping, with a smooth-edged knife, and the resulting hemp was much cleaner than that usually found in the market. While the above method of selection would not be rigid without a very large number of tests, still the results obtained so markedly and uniformly point in the same direction that little doubt is left as to the relative strength of the fibers. In making the tests, ten fibers at one time were twisted together and the number of kilos necessary to break them measured with a Riehle testing machine. Fifty lots of ten fibers each of hand and machine stripped hemp of the same length were then weighed to obtain the average weight of the fibers, so that any differences in breaking strain could not be ascribed to different sizes of the fibers used. An arbitrary strength factor X was then calculated, representing the breaking strength divided by the weight of the fibers. The results of the first series of tests are presented in Table I.[2]

[1] From The Philippine Journal of Science, Vol. IV, No. 2, March, 1909.

[2] These tests were made possible through the kind coöperation of Mr. M. A. Clarke, the machine used being that of the Manila Hemp Machine Company.

TABLE I.

Class of fiber.	Breaking strength in kilos.	Class of fiber.	Breaking strength in kilos.
Mindoro machine-stripped	21.4	Davao machine-stripped	31.4
Do	23.8	Do	33.6
Do	24.0	Do	31.0
Do	22.6	Do	34.5
Do	[a]34.0	Mindoro hand-stripped	14.5
Do	24.1	Do	18.6
Do	25.0	Do	16.3
Do	21.8	Do	14.1
Do	24.5	Do	[a]20.4
Do	26.9	Do	14.5
Do	22.3	Do	15.4
Do	27.6	Do	14.1
Do	28.1	Do	12.7
Davao machine-stripped	32.6	Do	17.7
Do	34.0	Do	13.2
Do	35.5	Do	14.1
Do	40.5	Do	15.4

[a] Picked samples.

The averages for the first series of tests are as follows:

Class.	Number of determinations.	Breaking strength in kilos.	Average weight of 10 fibers in grams.	Strength factor, X.
Mindoro machine	13	25.3	0.0509	50
Mindoro hand	13	15.4	0.0510	30
Davao machine	9	35.4	0.0716	48

In the second series of tests each leaf was split into two parts, one half was stripped by machine and the other half by hand. This lot of hemp was from Albay Province. The numbers opposite each other represent the same leaf, and hence are comparable. The results are presented in Table II.

TABLE II.

Breaking strength in kilos.		Breaking strength in kilos.	
Machine-stripped.	Hand-stripped.	Machine-stripped.	Hand-stripped.
26.8	[a]11.4	17.8	11.8
19.9	14.0	19.5	10.9
23.4	14.4	21.8	18.2
22.3	10.9	20.9	7.2
21.0	11.4	27.3	11.8
23.1	10.9	16.8	11.4
26.4	13.2	16.8	11.8
19.1	8.6		
16.8	11.8	[a]21.0	[a]12.2
15.0	8.6		

[a] Averages.

The average weight of the two classes of fibers in this last series was the same, so that their relative tensile strength is correctly given by the average breaking strain.

Many other determinations with the same results have been made. There is little doubt that the machine-stripped fiber is considerably stronger than the hand-stripped variety. To give a reason for this difference is another matter. Examination under the microscope showed that both classes of fiber were quite clean and revealed no differences between them. It is my opinion that the difference is due to the continuous, steady pull of the fiber under the machine's knife as compared to the intermittent jerky pull which is necessary in hand stripping. The jerks of the hand-stripper strain the fibers so as very markedly to lower their tensile strengh. Confirmatory evidence for this theory is given by the fact that hand-stripped hemp shows very many broken fibers, so that a bundle of this class of abaca consists of a series of shorter and longer fibers, while the machine-stripped abaca has practically no fibers broken and all are of the same length. The advent of the hemp-stripping machine should very materially advance the quality of Manila hemp.

THE AMENDED HOMESTEAD LAW.

By C. H. Sleeper, *Director of Lands.*

At its inaugural session the Philippine Legislature passed Act No. 1864, amending Chapter I of Act No. 926, the Public Land Act, relating to homesteads on the public domain. According to the provisions of law this amendment could not become effective until approved by the President and the Congress of the United States. The Act was approved by the President, and as Congress took no action the Act became a law as provided in section 13 of the Act of Congress dated July 1, 1902, and was proclaimed in the Philippine Islands by the Governor-General on June 21, 1909.

This amendment differs from the original Act in two important particulars; *first,* in the method of paying the required fees, and *second,* in the length of residence on the homestead by the applicant.

In the original Homestead Act a fee of ₱10 was required when the application for homesteads was approved, and ₱10 additional when the final proof was submitted. Final proof, which may be submitted at the expiration of five years after date of application, and must be submitted within eight years after date of application, consists of the affidavits of two witnesses that the applicant has resided upon and cultivated the land for the required number of years, and an affidavit that the land has not been sold or mortgaged, and that the applicant has borne true allegiance to the Government of the United States and the Philippine Islands. The amendment gives the applicant the option of paying the fees in the manner provided in the original Act or paying the same in installments of ₱4 each year, the first payment to be made upon approval of the application for a homestead.

The land must be cultivated for a period of five years from the date of filing the application, but the applicant must actually reside upon the land for two years immediately preceding the date of filing his final proof, while the original Act required a residence of five years. If the applicant elects to pay the fees for the homestead in installments, they may be paid to the municipal or provincial treasurer or to the Director of Lands. If, however, he fails to pay any installment within thirty days after it becomes due, all rights are lost and the applicant forfeits any installments which he may have previously paid. If the applicant

voluntarily abandons the land for more than six months at any one time during the two years' residence thereon, his entry is subject to cancellation by the Director of Lands at his discretion. A homestead entry may also be canceled if it is discovered that the applicant is not qualified to acquire a homestead or if he fails to cultivate the land as required by law, or if it is proven that the land which he has applied for is not open to homestead settlement.

The evident intention of the amendment to the Homestead Law was to encourage the very poorest class of people to take up homesteads and to grant such a period of time for the payment of the fees that anyone can make the payments, and to allow those who take up homesteads to cultivate their lands through agents while they are engaged in other occupations until such time as the land shall produce crops, when the applicant must reside thereon for two years prior to the submission of the final proof.

ESTIMATED COST AND PROFIT FROM PARA RUBBER CULTIVATION IN THE FEDERATED MALAY STATES.[1]

ESTIMATE FOR 1,000-ACRE ESTATE; 250 TO BE OPENED EACH YEAR.[2]

FIRST YEAR.

Premium	$3,000
Survey fees	1,000
Rent	1,000
Clearing, felling, and burning 250 acres ($15 per acre)	3,750
Lining, holing, and planting 250 acres ($6 per acre)	1,500
Plants	800
Roads and drains ($6 per acre)	1,500
Bungalow	2,000
Lines	1,500
Medical—hospital, medicines, etc	2,000
Labor—advances, immigration fees, etc	1,500
Superintendence	3,600
Tools and sundries	1,000
Total	24,150

SECOND YEAR.

Rent	$1,000
Clearing, felling, and burning 250 acres	3,750
Lining, holing, and planting 250 acres	1,500
Plants	800
Roads and drains	1,500
Medical	1,000
Labor	1,000
Superintendence	4,000
Tools and sundries	750
Weeding 250 acres	2,500
Supplying	100
Total	17,900

[1] From Agricultural Bulletin of the Straits and Federated Malay States, Vol. VIII, No. 5.

[2] Stated in Federated Malay States currency.

THIRD YEAR.

Rent	$1,000
Clearing, felling, and burning 250 acres	3,750
Lining, holding, and planting 250 acres	1,500
Plants	800
Lines	1,500
Roads and drains	1,500
Medical	1,000
Labor	1,000
Superintendence	4,000
Tools and sundries	1,000
Weeding 500 acres	6,000
Supplying	100
Total	23,150

FOURTH YEAR.

Rent	$1,000
Clearing, felling, and burning 250 acres	3,750
Lining, holing, and planting 250 acres	1,500
Plants	800
Roads and drains	1,500
Medical	1,000
Labor	1,000
Superintendence	4,000
Tools and sundries	1,000
Weeding 750 acres	12,000
Supplying	100
Total	27,650

FIFTH YEAR.

Rent	$1,000
Roads and drains	800
Medical	1,000
Labor	1,000
Superintendence	4,000
Tools and sundries	1,000
Weeding, 1,000 acres	15,000
Total	23,800

SIXTH YEAR.

Rent	$1,000
Roads and drains	800
Labor	1,000
Medical	1,000
Superintendence	4,000
Tools and sundries	1,000
Weeding 1,000 acres	17,000
Total	25,800

SEVENTH YEAR.

Rent	$4,000
Roads and drains	800
Medical	1,000
Labor	1,000
Superintendence	4,000
Tools and sundries	1,000
Weeding 1,000 acres	17,000
Total	28,800
Eighth and following years as seventh year	$28,800

With the exception that the cost of weeding gradually decreases till in the eleventh year it is practically nil.

PROFITS.[1]

SEVENTH YEAR.

250 acres, planted 150 trees per acre, at 1 pound rubber per tree, sold at 3 shillings per pound	$48,214
250 acres, planted 150 trees per acre, at 1½ pounds rubber per tree	72,321
Total	120,535
Less cost of production, shipping, etc., of 93,750 pounds, at 1 shilling 6 pence per pound	60,268
Net profit	60,267

EIGHTH YEAR.

250 acres, at 1 pound per tree and 3 shillings per pound	$48,214
250 acres, at 1½ pounds per tree and 3 shillings per pound	72,321
250 acres, at 2 pounds per tree and 3 shillings per pound	96,428
Total	216,963
Less costs of production, etc., 253,125 pounds, at 1 shilling 6 pence per pound	108,482
Net profit	108,481

NINTH YEAR.

250 acres, at 1 pound per tree and 3 shillings per pound	$48,214
250 acres, at 1½ pounds per tree and 3 shillings per pound	72,321
500 acres, at 2 pounds per tree and 3 shillings per pound	192,856
Total	313,391
Less cost of production, etc., 243,750 pounds, at 1 shilling 6 pence per pound	156,696
Net profit	156,695

[1] Stated in Federated Malay States currency.

TENTH YEAR.

250 acres, at 1½ pounds per tree and 3 shillings per pound	$72,321
750 acres, at 2 pounds per tree and 3 shillings per pound	289,280
Total	361,601
Less cost of production, etc., 262,500 pounds, at 1 shilling 6 pence per pound	180,800
Net profit	180,801

ELEVENTH YEAR.

1,000 acres, at 2 pounds per tree and 3 shillings per pound	$385,710
Less cost of production, etc., of 300,000 pounds, at 1 shilling 6 pence per pound	192,857
Net profit	192,853

And so on each year, annual profit $192,853, with a probability of still increased yield.

Abstract of profit and loss.[1]

Year.	Expenditure.	Profit on rubber.	Net profit on estate.
First	$24,150	----------	----------
Second	17,900	----------	----------
Third	23,150	----------	----------
Fourth	27,650	----------	----------
Fifth	23,800	----------	----------
Sixth	25,800	----------	----------
Seventh	28,800	$60,267	$31,467
Eighth	28,800	108,481	79,681
Ninth	28,800	156,695	127,895
Tenth	28,800	180,801	152,000
Eleventh	28,800	192,853	164,053
Twelfth	28,800	192,853	164,053

Expenditure with interest at 5 per cent, up to end of sixth year, $168,670 (£20,000).

Net profit on estate after deducting 5 per cent interest on capital:

Expended seventh year, $22,967, or 13 per cent; eighth year, $71,181, or 42 per cent; ninth year, $119,395, or 70 per cent; tenth year, $143,500, or 84 per cent; eleventh year, $156,553, or 92 per cent.

And so in future years with a probability of increased yields.

Capital expended, $168,670 (£19,678 3s. 4d.).

Profit, $22,967 (£2,679 9s. 8d.); $71,181 (£8,304 9s. 0d.); $119,395 (£13,929 8s. 4d.); $143,500 (£16,741 13s. 4d.); $156,355 (£18,241 8s. 4d.).

[1] Stated in Federated Malay States currency.

PHILIPPINE HEMP STATISTICS.[1]

HEMP RECEIPTS AND EXPORTS, 1901-1908, AND MONTHLY RECEIPTS, 1908.

Hemp receipts, 1901–1908.

[In piculs.]

Provinces.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
Albay	547,096	545,941	527,171	591,354	521,658	406,038	479,879	548,194
Sorsogon	190,764	172,640	281,957	210,878	212,184	157,072	231,912	198,786
Leyte	259,803	258,478	289,802	241,461	246,016	266,100	349,245	144,594
Samar	18,804	86,983	165,605	121,551	106,364	93,788	166,420	318,059
Camarines	158,876	170,401	182,835	162,736	173,108	147,390	132,264	179,283
Mindanao	81,910	68,706	33,940	42,574	51,210	55,320	74,816	93,742
Other districts	33,830	46,677	82,963	60,041	89,228	58,314	61,822	42,271
Cebu	62,343	84,564	129,092	72,630	59,834	32,866	17,960	29,975
At Manila	1,353,426	1,434,390	1,693,365	1,503,225	1,459,602	1,211,888	1,514,418	1,554,904
At Cebu	192,720	364,666	314,727	306,048	350,556	156,427	428,698	549,350
Grand total	1,546,146	1,799,056	2,008,092	1,809,273	1,810,158	1,368,315	1,943,116	2,104,254

Hemp exports, 1901–1908.

[In bales.]

Countries.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.
United States	186,707	399,099	465,318	341,408	400,193	399,822	344,979	384,330
Great Britain	653,822	380,161	451,103	433,284	359,249	310,880	396,014	437,710
California	24,802	34,436	63,512	88,784	85,392	54,282	54,959	84,854
Australia	15,784	9,927	14,564	61,158	55,419	11,128	13,710	16,518
Other parts	32,234	22,897	55,468			42,979	78,008	100,732
Total exports	913,349	846,520	1,049,965	924,634	900,253	819,091	887,670	1,024,144

[1] From the report of the committee of the Manila Chamber of Commerce for the year ending December 31, 1908.

Monthly hemp receipts, 1908.

[In piculs.]

Provinces.	January.	February.	March.	April.	May.	June.
Albay	41,884	39,402	58,712	29,442	38,056	41,532
Sorsogon	14,644	21,398	14,770	10,954	10,094	12,756
Camarines	9,776	12,114	9,584	13,600	11,128	13,188
Leyte	27,149	27,696	28,006	19,944	20,601	25,140
Samar	6,578	13,254	16,930	19,962	13,897	10,300
Mindanao	1,025	6,756	5,334	8,810	7,082	5,588
Other districts	2,640	4,128	3,612	2,596	2,446	2,724
Cebu	2,820	1,268	1,798	288	1,080	5,996
Total at Manila	106,516	126,016	138,746	105,596	104,384	117,224
Total at Cebu	22,008	46,970	62,208	46,236	37,560	48,806
Grand total	128,524	172,986	200,954	151,832	141,944	166,030

Provinces.	July.	August.	September.	October.	November.	December.	Total.
Albay	45,638	45,778	45,400	62,334	45,796	54,220	548,194
Sorsogon	15,938	27,450	16,452	22,012	15,606	16,712	198,786
Camarines	15,458	9,574	13,412	12,246	11,242	13,272	144,594
Leyte	24,670	25,269	26,910	28,620	26,825	37,229	318,059
Samar	16,616	10,529	16,784	13,598	18,547	22,288	179,283
Mindanao	7,016	6,959	9,400	12,626	13,046	10,100	93,742
Other districts	2,854	3,844	4,612	5,294	4,086	3,435	42,271
Cebu	3,682	2,211	3,010	138	1,208	6,476	29,975
Total at Manila	131,872	131,614	135,980	156,868	136,356	163,732	1,554,904
Total at Cebu	34,350	50,738	44,040	47,862	59,916	48,656	549,350
Grand total	166,222	182,352	180,020	204,730	196,272	212,388	2,104,254

PHILIPPINE SUGAR STATISTICS.[1]

SUGAR EXPORTS, BY PORTS AND COUNTRIES, 1898-1908.

Comparative statement of sugar exports, by ports, 1898–1908.

[In piculs.]

	1898.	1899.	1900.	1901.	1902.
Manila	251,169	80,374	404,813	68,523	7,017
Cebu	159,469	210,780	51,936	126,604	71,372
Iloilo	2,449,023	1,197,700	540,078	691,261	1,394,771
Total	2,859,661	1,488,854	996,827	886,388	1,473,160

	1903.	1904.	1905.	1906.	1907.	1908.
Manila	5,204	68,378	56,480	308,523	313,736	664,658
Cebu	59,486	24,856	34,641	14,946	48,011	63,426
Iloilo	1,332,263	1,213,272	1,588,771	1,666,671	1,590,556	1,460,991
Total	1,432,953	1,306,506	1,679,892	1,990,140	1,952,303	2,189,075

Comparative statement of sugar shipments to different countries, 1898–1908.

[In piculs.]

	1898.	1899.	1900.	1901.	1902.
Great Britain	675,670	132,792	203,970		99,468
United States and Canada	520,752	353,680	33,600	81,600	40,800
Continent of Europe	2,887	164,033			
China and Japan	1,660,352	838,349	759,257	804,788	1,332,892
California					
Total	2,859,661	1,488,854	996,827	886,388	1,473,160

	1903.	1904.	1905.	1906.	1907.	1908.
Great Britain		69,600	8,000		186,600	171,680
United States and Canada	540,880	334,288	686,877		139,200	728,000
Continent of Europe						
China and Japan	892,073	902,618	985,015	1,802,517	1,594,479	1,289,395
California				187,623	32,024	
Total	1,432,953	1,306,506	1,679,892	1,990,140	1,952,303	2,189,075

[1] From the report of the committee of the Manila Chamber of Commerce for the year ending December 31, 1908.

PHILIPPINE COPRA STATISTICS.[1]

COPRA EXPORTS, BY PORTS AND COUNTRIES, 1898-1908.

Comparative statement of copra exports, by ports, 1898–1908.

[In piculs.]

	1898.	1899.	1900.	1901.	1902.
Manila	252,840	215,819	982,647	488,602	647,875
Cebu	10,562	66,282	41,080	45,077	72,772
Iloilo		9,221			
Total	263,402	291,322	1,023,727	533,679	720,647

	1903.	1904.	1905.	1906.	1907.	1908.
Manila	1,035,014	547,955	699,336	738,433	578,829	1,123,326
Cebu	226,971	66,176	140,984	189,500	265,488	311,840
Iloilo					592	
Total	1,261,985	614,131	840,320	927,942	844,909	1,435,166

Comparative statements of copra exports to different countries, 1898–1908.

[In piculs.]

	1898.	1899.	1900.	1901.	1902.
Great Britain	12,180	47,704	48,882	9,095	59,200
Continent of Europe	248,655	246,366	970,888	522,665	651,971
United States					
China, etc	2,567	252	3,957	1,919	9,476
Total	263,402	291,322	1,023,727	533,679	720,647

	1903.	1904.	1905.	1906.	1907.	1908.
Great Britain	86,400	14,400	25,840	13,200	29,312	8,800
Continent of Europe	1,171,209	597,599	810,114	908,722	781,398	1,367,281
United States	2,656	1,600		6,000	33,399	59,085
China, etc	1,720	532	4,336	20	800	
Total	1,261,985	614,131	840,320	927,942	844,909	1,435,166

[1] From the report of the committee of the Manila Chamber of Commerce for the year ending December 31, 1908.

LONDON COPRA RECEIPTS.[1]

COPRA RECEIPTS, BY COUNTRIES, 1896-1908, AND BY MONTHS, 1908

Shipments from different countries, 1896–1908.

[London, February 26, 1909.]

[In tons.]

Year.	Java.	Macassar.	Sangir, Menado, and Gorontalo.	Padang.	Singapore and Penang.	Ceylon.	Manila.	Total.
1896	19,511	8,770	6,000	5,778	39,440	3,677	33,468	116,644
1897	5,630	4,076	4,000	2,678	30,000	7,831	46,290	101,098
1898	3,086	8,226	6,000	5,515	35,363	37,192	15,094	110,476
1899	46,011	12,012	10,486	3,900	52,182	23,905	12,253	160,749
1900	35,257	13,982	10,296	5,487	28,214	18,059	57,361	168,656
1901	27,688	12,151	10,482	4,737	26,111	21,916	28,854	131,939
1902	45,129	28,045	17,698	5,364	50,490	18,740	45,020	210,496
1903	15,406	9,799	11,653	6,231	52,420	34,713	78,874	209,096
1904	29,716	9,125	11,746	6,120	42,070	33,578	38,383	170,738
1905	107,709	25,961	19,514	6,580	58,915	17,740	49,715	286,134
1906	52,000	9,641	14,481	6,638	39,215	21,212	57,900	201,087
1907	69,666	17,248	16,080	8,694	55,120	16,898	53,531	237,237
1908	94,740	21,591	12,047	11,927	76,550	36,457	89,698	355,010
Total	551,549	180,627	150,483	79,649	586,683	291,918	606,451	2,459,350

Monthly receipts for 1908.

Month.	Java.	Macassar.	Sangir, Menado, and Gorontalo.	Padang.	Singapore and Penang.	Ceylon.	Manila.	Total.
January	10,376	1,384	1,420	1,189	7,060	400	6,000	27,829
February	6,917	1,665	1,235	864	3,830	971	1,250	16,732
March	6,485	1,118	1,606	1,045	4,835	1,848	7,500	24,437
April	4,385	1,380	1,791	321	4,610	2,449	4,000	18,936
May	6,917	1,437	2,717	597	7,155	450	5,000	24,273
June	8,585	2,669	2,470	823	7,835	1,814	9,000	33,196
July	8,585	1,297	2,038	919	7,840	1,816	4,350	26,845
August	7,411	2,603	1,976	1,725	9,670	2,613	9,750	35,748
September	11,425	1,820	2,162	1,351	9,055	6,918	7,250	39,891
October	7,720	2,148	2,409	1,278	7,015	4,869	12,750	38,189
November	6,670	2,295	2,223	808	4,645	6,455	11,000	34,096
December	9,264	1,775	2,000	1,007	3,000	5,854	11,848	34,748
Total	94,740	21,591	24,047	11,927	76,550	36,457	89,698	355,010

[1] From the report of the committee of the Manila Chamber of Commerce for the year ending December 31, 1908.

PHILIPPINE TOBACCO STATISTICS.[1]

SHIPMENTS OF LEAF TOBACCO, 1898-1908.

Comparative statement of shipments of leaf tobacco to different countries, 1898–1908.

[In quintals.]

	1898.	1899.	1900.	1901.	1902.
Great Britain	21,893	20,845	338	2,042	4,412
United States	312			53	1,138
Continent of Europe	143,153	89,094	185,013	169,770	179,432
China, etc	9,812	4,322	3,017	5,678	4,384
Total	175,170	114,261	189,368	177,543	189,366

	1903.	1904.	1905.	1906.	1907.	1908.
Great Britain	10,140	7,668	2,337	11,874	14,224	863
United States	88			1,310		
Continent of Europe	170,642	154,376	154,371	241,210	195,200	217,432
China, etc	3,129	3,754	5,236	22,647	12,660	6,329
Total	183,999	165,798	161,944	277,041	222,084	224,624

[1] From the report of the committee of the Manila Chamber of Commerce for the year ending December 31, 1908.

CURRENT NOTES.

THE COLLEGE OF AGRICULTURE.

With the opening of the new school year by the Bureau of Education began one of the very best enterprises for promoting practical and economic education in these Islands, namely, the Philippine College of Agriculture at Los Baños, La Laguna Province, under the direction of Dr. E. B. Copeland. Doctor Copeland is assisted in his work by Mr. Harold V. Cuzner, formerly horticulturist in this Bureau, as agriculturalist, Mr. E. M. Ledyard, formerly teacher of nature study and animal life in the Manila High School, as zoölogist, and Mrs. E. M. Ledyard, who has charge of the language work in the college. Between 50 and 60 students have enrolled; they will at first be housed in tents, where they will live until the necessary buildings which they themselves will erect have been completed. It is anticipated that the building fund provided by the Bureau of Education for a School of Agriculture at Los Baños will be made over to the University of the Philippines for the first buildings of the College of Agriculture. A definite site or university center has not yet been secured by the Board of Regents. The organic Act, however, provides that such site should be in the city of Manila. The site of the college contains about 75 hectares of good land on the lake shore beyond Los Baños. Part of this land is low and the remainder is high, so that diversified farming can be carried on. For admission to the College of Agriculture, the applicant must have completed a course of study equivalent to the primary and intermediate courses as given in the public schools and the first year of the secondary course. In default of these requirements the applicant will be required to pass an examination given by the faculty of the college.

It is the intention of Doctor Copeland and his associates to take up extension work among farmers as soon as possible and to have short courses at the college for them.

THE COLLEGE OF VETERINARY SCIENCE.

Act No. 1870 of the Philippine Legislature, enacted June 18, 1908, which provided for establishing the College of Agriculture of the University of the Philippines, also provided for the College of Veterinary Science to be located at Manila on the site of the animal quarantine station at Pandacan; suitable buildings have been authorized, including an animal hospital, dissecting room, and an instruction laboratory. The

College of Veterinary Science opened its first session on Monday, June 14, at the Philippine Medical School.

For admission to the College of Veterinary Science the requirements will be similar to those for admission to the Philippine School of Medicine and will presuppose the completion of the fourth year secondary, high school course, as given in the public schools. In default of these requirements or in case the candidate comes from a private institution he will be required to pass the Medical College entrance examination.

THE INSULAR LUMBER COMPANY.

Doubtless one of the first industries in the Philippines is that of the Insular Lumber Company at Sagay, at the north end of the Island of Negros. It is said that this company has invested ₱1,000,000 and that it is doing much toward supplying the local market with Philippine woods, which otherwise would be supplied with Oregon pine and California redwood. In addition to supplying the Philippine market, two of the largest timber markets in the Far East, Australia and China, which consumed not less than 156,000,000 feet of Oregon pine and California redwood last year, are open to timber from Philippine forests.

PHILIPPINE FORESTS.

From the following report by the Director of Forestry it will be seen that the Philippine forests are sixth in the list of available forest lands.

State.	Forest area (hectares).	Cost per hectare.	Net revenue per hectare.	Number of foresters.	Number of rangers and guards.	Total expenses.	Net revenue.
Germany and Prussia	2,465,000	₱6.90 —	₱6.30	806	3,739	₱17,000,000	₱15,776,000
India	19,000,000	.45 +	.39 +	312	9,203	8,532,000	7,416,000
Java	2,700,000	.64	.61 —	30	1,000	1,728,000	1,628,000
Japan	12,000,000	.08 +	.16 +	325	1,434	1,000,000	2,000,000
Philippine Islands[a]	6,000,000	.018+	.016+	9	25	110,000	100,000

[a] There are 16,000,000 hectares of public forests, only 6,000,000 of which are being exploited.

THE BEETLE PEST.

According to Dr. E. B. Copeland, dean of the Philippine Agricultural College at Los Baños, beetles are at this time probably our most dangerous and destructive agricultural pest. Doctor Copeland believes that beetles are far more destructive to coconut trees in the Philippines than typhoons. Writing on this subject in the December number of the Philippine Journal of Science, Doctor Copeland suggests that there should be legislation for the purpose of securing the total suppression of this pest, as has been done in other countries. He says, "The Provinces of La Laguna and Tayabas have passed ordinances against a local coconut pest, the bud rot, and have very promptly reduced it to comparative harmlessness, but single provinces can not deal effectively with beetles. The Straits

Settlements, the Federated Malay States, and Ceylon have for years had laws aimed at the suppression of beetles, and their value is well proved. Coconut products are second only to abaca in the value of exports of the Philippines. The beetles are probably at this time our most dangerous and most destructive agricultural pest."

PHILIPPINE TERPENES AND ESSENTIAL OILS.

A general survey of the field of terpenes and essential oils in the Philippines made by Dr. Raymond F. Bacon of the Bureau of Science, has demonstrated the fact that a profitable business can be worked up in the collection of some of those existing in this country which have a commercial value in the United States and foreign countries. Doctor Bacon has collected over 100 specimens of *elemi* or resins in several different localities.

THE DIVISION OF ANIMAL INDUSTRY OF THE BUREAU OF AGRICULTURE.

The division of animal industry of the Bureau of Agriculture divided the Islands into two districts, and provision has been made for two traveling veterinarians, namely, Dr. S. Youngberg and Dr. R. F. Knight, as district veterinarians. Doctor Youngberg has been appointed chief veterinarian of the first district, which embraces all the provinces in the Island of Luzon and the adjacent islands south to the Visayas. Doctor Knight has been appointed chief veterinarian for the second district, which includes Panay, Negros, Cebu, Leyte, Samar, and the islands to the south. In case of serious outbreaks of any animal disease in the future, the district veterinarian will take personal charge of the campaign, and every veterinarian, inoculator and temporary employee of the district will be required to submit reports, and it will be the duty of the chief veterinarian to secure data on the results of inoculations and other methods used in combating animal diseases.

PHILIPPINE SPONGE FISHERIES.

According to the fishery expert of the Bureau of Science, Mr. Alvin Seale, the past year has marked the opening of the Philippine sponge fisheries from a commercial standpoint. Some 30,000 sponges were shipped from the Islands during the past year. The greater part of these were sold in Singapore for export to London. Samples of these sponges were taken to the United States Bureau of Fishery, where they were compared with specimens from Florida, Cuba and the Mediterranean. Samples were also taken to the wholesale sponge dealers in New York and San Francisco, who examined them with a great deal of interest.

PHILIPPINE COAL.

For the first time in history an Army transport, the United States Army transport *Dix,* on her last voyage homeward, left these Islands

with 2,500 tons of Philippine coal, mined on the Island of Batan, in her hold and bunkers. In case this experiment proves successful it will be possible to use Philippine coal instead of Japanese or Australian coal in so far as the Philippine mines are able to supply the demand.

DENATURED ALCOHOL.

From those informed on the subject, we understand that the owners of "nipales" or nipa plantations are very much interested in a law providing for the manufacture and sale of denatured alcohol free from internal-revenue tax. It is claimed that this commercial article which is used for heating and many other practical purposes can be made from the sap of the nipa palm and that in this way the factories in such sections as Capiz, Bulacan, and Pangasinan, which have been devoted to the making of native wines from nipa sap, could be diverted to the manufacture of denatured alcohol.

A PHILIPPINE BOTANICAL GARDEN.

The Director of the Bureau of Science in his last annual report calls attention to the need of a botanical garden in connection with the scientific and the economic study of plant life in these Islands which would be quite as valuable to the Bureaus of Agriculture and Forestry as to the Bureau of Science. He says: "Many, if not all, of the countries of the Far Eeast have established botanic gardens either directly in their principal cities, or at least within easy reach of them. The importance of such botanic gardens to the economic development of the countries in question can not be doubted, and it is recommended that measures be taken at an early stage to establish a similar institution here." In connection with the above statement by the Director of the Bureau of Science it is desired to call attention to the fact that in every tropical country where a scientific study is made of the botany, agriculture, and forestry of the country, botanic gardens have been established and are one of the best means of studying the plant life of the country. As examples we call attention to the botanic gardens in Buitenzorg for the Dutch East Indies, in Singapore for the Straits Settlements and Federated Malay States, in Peradeniya for Ceylon and India, in Kingston, Jamaica, Bridgetown, Barbados, in Trinidad, and in practically every colony in the tropics where agriculture receives any considerable attention.

NOTES FROM OTHER FIELDS.

RICE INVESTIGATIONS IN INDO-CHINA.

According to the Bulletin Économique for March and April the agriculture service for Indo-China is actively carrying on an investigation and study of the different kinds of rice raised in Indo-China with the purpose of scientifically classifying the same. The improvement of the different varieties by the careful selection of seed is being diligently carried on. At the experiment station at Thanh-Ba a variety of rice from Italy is being cultivated side by side with a local variety of mountain rice known as "lua-ken-do." The soil was manured at the rate of 300 kilos of manure of the farm per are. All of the results of this trial have not yet been received by the director of agriculture, forestry, and commerce. At the experiment station at Phumy the local branch of the agricultural department of Cochin China has begun an experiment for the purpose of showing the value of sulphate of manganese on the yield of grain in the cultivation of rice. In the first series of experiments sulphate of lime was used at the rate of 90 kilos per hectare, and for the sulphuric acid 100 kilos of sulphate of manganese. In the second series of experiments 100 kilos of sulphate of manganese were applied to each hectare.

YLANG YLANG IN INDO-CHINA.

The agricultural service of Tonkin has been occupied in producing a sufficient number of plants of the *Cananga odorata* (ylang-ylang) to supply the demand for this plant from the planters of Tonkin. The nurseries of the Botanic Gardens in Hanoi are prepared to distribute more than 8,000 plants; these plants were produced from seeds obtained from trees in the botanical gardens in Hanoi, from seed received from Manila and from the Bureau of Agriculture of Cochin China. The seeds from the Botanic Garden in Hanoi seem to furnish a variety which is more regular and rapid in its growth than those obtained from other countries.

KAPOK IN INDO-CHINA.

According to the Bulletin Économique for March and April, the Cambodia branch of the department of agriculture, forestry, and commerce for Indo-China has begun an investigation concerning the kapok plantations in that country. Correspondence with several scientific establishments in Paris, with foreign countries and with the French

Chamber of Commerce has been begun with a view to preparing a statement regarding this very interesting industry. English machinery makers have also been addressed inquiring about machinery for the purpose of taking out the seed or ginning the fiber of the plant.

FOURTH SUGAR MILL FOR FORMOSA.

The Honolulu Iron Works have secured the contract for building a fourth sugar mill in Formosa for Japanese capitalists. It is stated that the sugar production of Formosa for the coming year will amount to about 80,000 tons. In the Philippine Islands there are very few modern or up-to-date sugar mills, and but one sugar refinery which has very little if any really modern machinery.

JAPAN'S SUGAR SUPPLY.

It is obvious that Japan has not hitherto depended alone on Formosa for her supply of sugar. Korea and Manchuria are at present only importers, but it is the intention of Japan to encourage the planting of the beet in Manchuria, and it is not at all impossible that in time that country may become one of the sources from which Japan will obtain sugar. Japanese supplies of the higher grades have hitherto come from Germany and Austria-Hungary, and from Russia until the commencement of the war. For the lower grades she draws upon Java, the Philippines, and Formosa. As there is no reason why the production of Formosa should not in time be quadrupled, it is possible that Formosa may eventually become the principal source of supply to Japan, and in that case the sugars to be first affected will be those imported from Java and the Philippines. In fact the Formosan centrifugals in the modern mills are already, to some extent, displacing the products of these two countries, more especially as regards Java. In view of the fact that Formosan sugars are admitted free of duty into Japan, it stands to reason that neither Java nor the Philippines will be able to compete, and must eventually give way as the exports from Formosa to Japan increase.

COCONUTS AND RICE IN THE STRAITS SETTLEMENTS.

In a letter received from Mr. Henry N. Ridley of the Botanic Gardens at Singapore, Straits Settlements, dated June 14, 1909, he makes the following statement:

Coconuts.—We have practically no disease except coconut bettles and one or two other insects which attack the folliage. Accounts of these have been published in the Agricultural Bulletin and the history of the coconut beetles in the Straits Branch of the Asiatic Journal, 1889. Nearly all of the industry is in the hands of natives who use no machinery. The nuts are husked with a large-bladed knife stuck in the ground. The ovens are very poor brick ovens with a fire inside; on the brick arch above the copra is dried in wet weather. The greater part is dried in the sun.

Rice.—There is a good deal of fancy as to the best rices grown here and some 80 or 90 kinds are all popular. The bulk of the rice consumed here comes from Bangkok and Rangoon. Practically nothing has been written on the local rice cultivation of any importance, except a few articles on padi pests in the Perak Museum Notes and Bulletin.

"BAGASSE" AS A PAPER PULP IN TRINIDAD.

Trinidad planters claim to have proven by successful experiments that sugar-mill owners can engage in the side manufacture of making paper out of "bagasse" or "magasse," as it is sometimes called. One mill owner has already built an $85,000, United States currency, plant as an adjunct to his sugar mill, and paper worth $24, United States currency, a ton has been turned out at this plant. It is reported that the process of manufacture is comparatively inexpensive, and that the paper alone will pay the expense of growing the sugar cane and running the mills, leaving the sugar as clear profit. In the Philippines as in Cuba it is believed that "bagasse" is worth more as fuel than as a pulp for paper-making purposes.

THE STUDY OF FOREST TREES BY THE UNITED STATES DEPARTMENT OF AGRICULTURE.

The Bureau of Forestry of the United States Department of Agriculture with the assistance of the teachers and pupils in the schools and other friends of the Bureau are obtaining data with reference to the *time of leafing, blossoming, and fruiting of the most important forest trees* of the United States. To do this, the Bureau has to depend largely upon the coöperation of a large number of volunteer observers. On request, the Bureau of Forestry furnishes forms upon which to record the data and a pamphlet containing full instructions as to the nature of the observations and how they are to be made. For educational purposes the results obtained for each species, averaged and presented graphically by means of colored charts, will be available to all who are interested in the subject, and particularly to schools. They will form virtual "tree calendars," and will be valuable aids to nature study. Such a work in the Philippines would not only be of great value to everyone interested in nature study and botany but to those interested in the study of the plant life of the Islands from an economic standpoint—to the Bureau of Agriculture and Forestry as well as to the Bureau of Science.

THE NATIONAL IRRIGATION CONGRESS.

The National Irrigation Congress of the United States will hold its seventeenth session in Spokane, August 9 to 14. In 1902, when the National Reclamation Act was passed, there were in the Government's name, in the 16 different States affected, 600,000,000 acres of arid land,

of which it was estimated that it would be possible to reclaim a sufficient amount to support 50,000,000 people. By 1911 the reclamation service will have reclaimed nearly 2,000,000 acres. The announcement of this congress, which is to be held during the present month, suggests the holding of a conference or congress of those interested in Philippine irrigation projects at the next Carnival.

EDIBLE FAT FROM COPRA.

German manufacturers are said to have succeeded in producing an excellent edible fat from copra, the meat of the coconut. The substance, which is known as "palmin," is used for cooking and is described as a hard, snow-white, vegetable fat of practically 100 per cent purity. While the process of manufacture was originally a secret, so many factories manufacturing similar lines have recently sprung up in Germany that it can no longer be so considered. The chief factory for the manufacture of "palmin" is at Mannheim; owing to its success the company has now put on the market a substitute for butter made from copra and called "palmona." The price of "palmin" is said to be less than that of other cooking fats and that of "palmona" much less than that of butter. The output of the factory, which amounts to between 20 and 25 million pounds a year, is usually sold far in advance.

THE DISTRIBUTION OF IMPROVED VARIETIES OF SEED.

The May number of the Queensland Agricultural Journal quotes from a bulletin issued by the director of the Kansas Agricultural College calling attention to the work being done in the United States in distributing improved seed wheat which has been very carefully tested. There were 3,995 bushels distributed to 638 farmers in 99 counties from the Manhattan station alone. The Fort Hays station distributed 3,980 bushels to 563 purchasers. In the same number, the Journal publishes rules for judging wheat and corn. This work suggests the careful trying out of the different kinds of rice, sugar, and tobacco raised in the Philippines, the publication of rules or standards of judging these plants and their products, and the distribution of the varieties found to be the best by the Bureau of Agriculture. At present comparatively little is known regarding the best varieties of rice, sugar, corn, hemp, and the other agricultural and economic plants of the Philippines, and it would seem that definite information on these subjects should be obtained as soon as possible.

CACAO IN SANTO DOMINGO.

The unprecedented export from Puerto Plata of 16,597,219 pounds of cacao in 1908 must be attributed to the developmente of the cultivation of the cacao bean, and to the suppression of the competitive conditions which in 1907 caused the deviation of large shipments to the port of Sanchez. Cacao is the most promising product of the Dominican Republic; the large extent of land suitable for its cultivation and the

continual efforts made by foreign as well as native planters afford ample assurance that the production of the country will soon place it in the second or third rank of the cacao-producing countries of the world. The average yield per annum of the trees is somewhat over 3 pounds, and on some plantations as high as 4 pounds, averages which compare most favorably with the results obtained in other countries where more scientific methods are used.

"MALVA." (MELOCHIA PIRAMIDATA.)

The Cuban Jute Company is the name of a new concern recently established at Habana with a capital of $250,000, to work the "malva," a wild textile plant, producing a fiber said to be similar to the best Indian jute. The "malva" (*Melochia piramidata*) grows abundantly in the island. The new company will devote itself to the manufacture of sugar sacks, for which the demand in Cuba is enormous, being calculated at a total value of about $2,000,000. These sacks come at present from the waste products of the factory for paper making.

MANICOBA RUBBER IN JAMAICA.

In November, 1908, we received from the director of the Royal Gardens, Kew, 3,250 seeds of "jequié manicoba" (*Manihot dichotoma*) and 4,320 seeds "piauhy manicoba" (*Manihot piauhyensis*). Half of each kind of seed was sown at Hope Gardens, the other half being sown at Castleton Gardens. Some of the seeds of "jequié" germinated freely and we have now about 350 plants potted and ready for distribution.

The season for extracting the latex from the "jequié manicoba" extends from August to March. The latex possesses the valuable property of coagulating spontaneously when exposed to the air and requires no acid or other artificial coagulant of any kind. The market value of the two kinds of rubber, according to the rate of October 28, was for *M. piauhyensis,* 7 shillings 6 pence per kilo; *M. dichotoma,* 8 shillings to 8 shillings 6 pence per kilo.

AGRICULTURAL CONDITIONS FOR THE MONTH OF MAY.

WEATHER CONDITIONS.

The weather conditions in different parts of the Islands during the past four weeks have been somewhat varied. The rains have been later this year than last; however, some portions of the Islands have received a considerable amount of rainfall, while in others the crops, especially rice and corn, are suffering from drought, Nevertheless, it may be said that agricultural conditions in general are improved.

IRRIGATION.

In some districts where there has been little rainfall the planters are realizing the benefits derived from irrigating their lands. In the northern part of Bulacan and southern Nueva Ecija the planters have made use of the water in wells and rivers to irrigate their lands before plowing, also in preparing their "semilleros" for seed, which has not yet been transplanted.

MISCELLANEOUS CROPS.

Rice.—During the month of May abundant crops of rice were harvested in the following provinces: Bulacan, Pampanga, Leyte, Nueva Ecija, Tayabas, Samar, Albay, Ambos Camarines, Sorsogon, Oriental Negros and Laguna, and in many of the municipalities of Isabela, Nueva Ecija, Ilocos Sur, and other provinces the "semilleros" were sown. So far the prospects for the rice crop are encouraging.

Corn.—A considerable amount of corn has been harvested in Leyte, Cagayan, and Cebu. The corn fields are in a very satisfactory condition in Cabadbaran, Agusan. In other parts of the Islands it is not possible to predict what the harvests will be; much depends upon the rainfall.

Sugar cane.—Reports from Pampanga, Tarlac, and Occidental Negros regarding sugar cane are promising, although locusts are causing a great deal of damage in the last-named province. A considerable amount of sugar has already been harvested in the municipalities of Sagay, Saravia, San Carlos, Cadiz, and La Carlota. The harvest of sugar cane in other provinces depends largerly upon the rainfall. At present the fields are in good condition.

Hemp.—Large crops of hemp have been harvested in Leyte, Sorsogon, Albay, Ambos Camarines, and Tayabas. A report from Cabadbaran,

Agusan, states that the price of hemp rose for some time in that locality, which was a great encouragement to the planters, but it has since fallen, being worth only 9 centavos per kilo at the present time.

Tobacco.—Large harvests of tobacco have been gathered in Cagayan, Cebu, La Union, and Pangasinan.

AGRICULTURAL PESTS.

Locusts are at the present time the greatest plague of the planters, and every effort is being made to destroy them. They have caused great damage to the rice and corn fields, as well as to the sugar plantations in many of the provinces. Locusts have been more troublesome in Oriental Negros, Batangas, Cebu, and Bohol. Young locusts appeared in Victoria, Tarlac, in large numbers, but were destroyed before they did much damage to the crops. At Maragondon, Cavite, 250 cavanes of locusts were caught.

Information has been received from Ambos Camarines that rats have done some damage to the rice fields, and in some places the corn fields and sugar plantations.

ANIMAL DISEASES.

Animal diseases are still reported from Cagayan and Batangas. Nevertheless conditions are improving, as the more dangerous diseases are disappearing from Antique, Tarlac, Pampanga, Pangasinan, Isabela, and other provinces. Reports show that rinderpest has entirely disappeared from Himamaylan, Occidental Negros, and San Miguel, Ilocos Norte.

Rinderpest has made its appearance in Cavite and Bataan. The ravages have been the greatest in Orion, Bataan, owing to the inability of the officials to enforce the quarantine regulations.

Rinderpest has practically disappeared from the towns of Siquijor and Larena, Oriental Negros; anthrax has disappeared in Cuenca, Batangas, and surra in Bohol. There has been a marked improvement in the condition of cattle in Bacnotan and Aringay in Union Province, also in Maasin and Hilongos in Leyte, Calbiga in Samar, and Candelaria in Tayabas.

CROPS PLANTED AND HARVESTED AND CONDITION OF SAME TAKEN FROM MONTHLY CROP REPORTS FOR THE MONTH OF MAY, 1909.

[NOTE.—Attention is invited to the fact that rice should be understood as being in the unhulled state. 75 liters=1 cavan; 63.25 kilos=1 picul; 46 kilos=1 quintal; 11.5 kilos=1 arroba; 0.4047 hectare=1 acre.]

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Area.	Quantity.	Unit.
Agusan (reports from 3 towns):		*Hectares.*	*Hectares*		
Corn	Good	30	10	11,250	Liters.
Abaca	Fair		150	23,719	Kilos.
Coconuts	Good			10,000	Nuts.
Rice	Fair				
Albay (reports from 14 towns):					
Abaca	Good	218	6,533	1,101,246	Kilos.
Rice	do	579	200	164,250	Liters.
Coconuts	do			754,000	Nuts.
Corn	do	77	79	34,300	Liters.
Ambos Camarines (reports from 25 towns):					
Rice	do	479	1,493	1,282,800	Liters.
Abaca	do	152	3,319	795,495	Kilos.
Coconuts	Fair			1,052,000	Nuts.
Corn	do	278	76	14,100	Liters.
Antique (reports from 9 towns):					
Rice	Good	2,855			
Sugar cane	do		98	154,963	Kilos.
Corn	do	476	69	19,875	Liters.
Abaca	do	10	11	3,226	Kilos.
Bataan (reports from 7 towns):					
Rice	do	78	550	300,750	Liters.
Corn	Fair	1,348	5	8,550	Do.
Sugar cane	do				
Batangas (reports from 10 towns):					
Rice	Fair	8,720			
Sugar cane	Good	71	60	80,328	Kilos.
Corn	Fair	1,578			
Abaca	do		33	4,364	Kilos.
Benguet (reports from 12 towns):					
Rice	do	16			
Coffee	Good	2			
Corn	do				
Sugar cane	Fair			1,139	Kilos.
Bohol (reports from 24 towns):					
Rice	Good	425	1,606	762,750	Liters.
Corn	Fair	2,504	84	25,875	Do.
Coconuts	do			1,479,000	Nuts.
Abaca	do	2	433	59,835	Kilos.
Bulacan (reports from 13 towns):					
Rice	Excellent		867	4,454,400	Liters.
Sugar cane	Fair	25		15,813	Kilos.
Corn	Good	10			
Tobacco	Fair	25		23,460	Kilos.
Cagayan (reports from 12 towns):					
Rice	Good	174			
Corn	do	2,194	711	1,278,900	Liters.
Tobacco	Fair		2,520	951,740	Kilos.
Sugar cane	do	9			

Crops planted and harvested and condition of same taken from monthly crop reports for the month of May, 1909—Continued.

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Area.	Quantity.	Unit.
Capiz (reports from 21 towns):		*Hectares.*	*Hectares.*		
Rice	Good	8,181			
Abaca	Fair	57	105	37,381	Kilos.
Tobacco	do	5	21	36,570	Do.
Corn	Good	687	4	1,125	Liters.
Cavite (reports from 7 towns):					
Rice	do	105			
Corn	Fair	54			
Sugar cane	Good				
Abaca	do				
Cebú (reports from 27 towns):					
Corn	Fair	17,058	569	342,525	Do.
Tobacco	do		3,634	671,600	Kilos.
Sugar cane	Good	131	94	370,835	Do.
Abaca	do	377	212	100,188	Do.
Ilocos Norte (reports from 10 towns):					
Corn	Fair	159	105	73,350	Liters.
Tobacco	Good	4	185	125,902	Kilos.
Maguey	do	15		696	Do.
Rice	Fair	58			
Ilocos Sur (reports from 21 towns):					
Corn	Good	1,204	509	140,775	Liters.
Tobacco	do		275	60,904	Kilos.
Sugar cane	do				
Maguey	Fair	26	700	190,572	Do.
Iloilo (reports from 15 towns):					
Tobacco	Good		320	58,328	Do.
Corn	do	2,910	113	59,700	Liters.
Sugar cane	do	73	40	20,240	Kilos.
Rice	do	3,660			
Isabela (reports from 5 towns):					
Tobacco			570	179,400	Do.
Corn	Fair	652		16,875	Liters.
La Laguna (reports from 17 towns):					
Coconuts	Good			3,415,000	Nuts.
Abaca	do	5	984	72,674	Kilos.
Rice	do	320	499	1,081,800	Liters.
Sugar cane	Fair	210	80	227,700	Kilos.
La Union (reports from 9 towns):					
Rice	Good	237			
Corn	do	346			
Tobacco	do		3,161	621,460	Do.
Maguey	do		15	4,744	Do.
Lepanto-Bontoc (reports from 15 towns):					
Rice	do	356	26	53,175	Liters.
Corn	Fair	204	9	1,275	Do.
Sugar cane	Good	14	2	6,325	Kilos.
Tobacco	do		67	26,266	Do.
Leyte (reports from 11 towns):					
Rice	do	30	3,627	3,481,875	Liters.
Abaca	do	191	1,592	536,613	Kilos.
Corn	do	572	513	604,125	Liters.
Coconuts	Fair			1,232,000	Nuts.
Mindoro (reports from 2 towns):					
Rice	Good	440			
Abaca	do		10	886	Kilos.
Coconuts	do			9,000	Nuts.
Corn	do	4			
Misamis (reports from 4 towns):					
Abaca	Poor	50	350	75,457	Kilos.
Coconuts	Fair			511,000	Nuts.
Corn	Poor	440	11	16,800	Liters.
Sugar cane	Good	10	10	25,300	Kilos.
Moro (reports from 5 towns):					
Rice	do	10	100	112,500	Liters.
Abaca	do		218	113,154	Kilos.
Coconuts	do			38,000	Nuts.
Corn	do	4			

Crops planted and harvested and condition of same taken from monthly crop reports for the month of May, 1909—Continued.

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Area.	Quantity.	Unit.
		Hectares.	*Hectares.*		
Nueva Ecija (reports from 15 towns):					
Rice	Fair	370	440	2,025,000	Liters.
Corn	do	480			
Sugar cane	Good	115	5	3,163	Kilos.
Tobacco	Fair		49	16,560	Do.
Nueva Vizcaya (reports from 3 towns):					
Rice	Good				
Sugar cane	do				
Tobacco	Poor				
Corn	Fair				
Occidental Negros (reports from 12 towns):					
Sugar cane	Good	810	2,090	2,555,300	Kilos.
Corn	Fair	585	135	60,750	Liters.
Coconuts	Good			307,000	Nuts.
Abaca	do	23	66	42,378	Kilos.
Oriental Negros (reports from 14 towns):					
Sugar cane	Fair	81	65	237,188	Kilos.
Rice	Good	440	750	1,125,000	Liters.
Corn	Fair	4,210			
Tobacco	do		302	207,552	Kilos.
Pampanga (reports from 9 towns):					
Rice	Good	53	9,746	4,624,875	Liters.
Sugar cane	do	6,050	2,916	1,265,000	Kilos.
Corn	do	3,838	235	338,250	Liters.
Pangasinan (reports from 31 towns):					
Rice	do	1,483			
Corn	Fair	2,553	420	421,125	Liters.
Coconuts	Good			427,000	Nuts.
Tobacco	do	30	536	619,988	Kilos.
Rizal (reports from 14 towns):					
Rice	do	29	76	159,000	Liters.
Corn	Fair	424		12,600	Do.
Sugar cane	Good	215			
Abaca	Fair	2			
Samar (reports from 20 towns):					
Abaca	Good	145	542	219,794	Kilos.
Corn	do	371	31	6,975	Liters.
Rice	Fair	179	2,380	1,565,700	Do
Coconuts	do			422,000	Nuts.
Sorsogon (reports from 18 towns):					
Rice	Fair	97	2,863	1,250,025	Liters.
Abaca	do	94	4,035	980,628	Kilos.
Sugar cane	do	37	23	4,068	Do.
Corn	do	252	25	8,925	Liters.
Surigao (reports from 2 towns):					
Rice	do				
Abaca	Good	8	10	3,163	Kilos.
Coconuts	do			5,000	Nuts.
Tarlac (reports from 9 towns):					
Rice	Fair	803			
Sugar cane	do	85	102	265,650	Kilos.
Tobacco	Good	14	15	690	Do.
Corn	Fair	165	20	1,500	Liters.
Tayabas (reports from 16 towns):					
Coconuts	do			1,572,000	Nuts.
Rice	Good	1,223	1,509	1,801,275	Liters.
Tobacco	do		50	14,766	Kilos.
Abaca	Fair	8	289	55,407	Do.
Zambales (reports from 8 towns):					
Rice	Good	163			
Coconuts	do			8,000	Nuts.
Corn	do	16	66	99,075	Liters.
Maguey	do		5	380	Kilos.

RANGE OF PRICES OF PHILIPPINE AGRICULTURAL PRODUCTS.

Highest and lowest prices of rice, abaca, copra, sugar, tobacco, and corn for the month of May, 1909.

[NOTE.—75 liters=1 cavan; 63.25 kilos=1 picul; 46 kilos=1 quintal.]

Province.	Unhulled rice per 75 liters.		Abaca per 63.25 kilos.		Copra per 63.25 kilos.		Sugar per 63.25 kilos.		Tobacco per 46 kilos.		Corn per 75 liters.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
Agusan	₱3.00	₱2.00	₱8.00	₱5.06	₱7.00	₱7.00					₱2.00	₱2.00
Albay	3.25	1.50	8.50	5.00	7.50	6.00	₱6.00	₱6.00			5.00	1.50
Ambos Camarines	3.50	2.00	9.00	4.00	7.00	5.00	5.00	4.00	₱12.00	₱12.00	4.00	1.00
Antique	3.12	1.75	22.00	12.00	6.50	6.00	5.00	3.00	25.00	6.00	2.50	1.25
Bataan	2.75	1.25					6.00	4.00			4.00	2.00
Batangas	3.50	2.60	10.00	6.00			7.00	3.00	8.00	8.00	3.12	2.00
Benguet	8.00	5.00					6.00	3.00			5.00	4.00
Bohol	3.50	2.00	12.00	8.00	9.25	7.00	6.00	4.00	24.00	4.00	4.00	2.50
Bulacan	2.50	1.80					7.00	6.50	18.00	12.50	2.50	2.00
Cagayan	4.50	3.50					7.00	4.00	25.00	9.00	6.00	2.00
Capiz	3.25	1.75	16.00	7.00	7.20	5.00	7.00	5.00	40.00	4.00	2.30	1.20
Cavite	3.00	2.40	11.00	11.00			2.75	2.75				
Cebu	4.50	2.50	16.00	5.50	9.00	8.00	4.00	2.00	35.00	2.50	5.00	3.50
Ilocos Norte	5.00	2.50			5.00	2.50	8.00	2.50	18.00	3.00	3.00	1.00
Ilocos Sur	5.00	3.00			10.00	10.00	7.00	2.00	25.00	3.00	4.00	2.00
Iloilo	5.00	2.50	18.00	12.00	9.00	6.00	5.50	4.00	18.00	5.00	4.00	2.50
La Laguna	3.50	2.00	16.00	5.00	7.00	4.75	5.80	3.60			5.00	2.50
La Union	5.00	3.50			6.00	6.00	5.00	4.50	9.00	2.25	4.00	4.00
Lepanto-Bontoc	6.00	3.50					4.00	3.50	20.00	4.00	5.00	5.00
Leyte	5.00	2.00	11.00	6.00	8.00	3.50	7.50	4.50	20.00	15.00	4.00	2.00
Mindoro	3.00	3.00	12.00	12.00								
Misamis	3.50	3.00	11.00	6.00	8.00	6.75	4.00	4.00	20.00	20.00	6.00	2.00
Moro	3.00	2.25	11.00	8.00	7.50	7.00					2.50	2.50
Nueva Ecija	3.60	1.25					7.50	2.50	20.00	5.00	2.50	2.50
Nueva Vizcaya	2.00	1.50									2.00	2.00
Negros Occidental	3.12	2.50	11.00	8.00	9.00	5.00	5.50	3.75	35.00	6.50	4.50	2.00
Negros Oriental	5.00	3.50	14.00	6.00	9.00	6.50	4.00	5.50	25.00	5.00	6.00	3.50
Palawan	3.00	3.00										
Pampanga	2.50	1.50					5.50	4.10			2.50	1.50
Pangasinan	5.50	1.70			7.00	2.50	6.40	3.20	30.00	6.00	5.00	1.50
Rizal	3.00	2.50					7.00	5.00			2.50	2.50
Samar	4.50	2.00	12.00	6.00	7.50	5.50	5.00	5.00	25.00	10.00	2.00	1.50
Sorsogon	3.75	2.50	13.75	5.00	7.00	2.50	6.75	3.00	26.00	3.50	2.50	1.50
Surigao	2.50	2.50	10.00	8.10	6.50	6.00						
Tarlac	4.50	1.50			4.50	4.50	6.00	3.00	7.00	6.50	2.60	1.25
Tayabas	5.00	2.00	12.00	3.00	6.20	4.00			10.00	3.00	2.50	2.50
Zambales	4.50	1.60			5.00	5.00	6.00	4.00			6.00	1.50

PERIODICALS IN THE LIBRARY OF THE BUREAU OF AGRICULTURE.

Everyone interested in the study of tropical agriculture is invited to visit the library and make use of these periodicals.

ENGLISH.

GENERAL.

Agricultural Bulletin of the Straits and Federated Malay States, Singapore.
The Queensland Agricultural Journal, Brisbane, Australia.
The Agricultural Gazette, Sydney, New South Wales.
Journal of the Department of Agriculture of Victoria, Melbourne, Australia.
Journal of the Department of Agriculture of Western Australia, Perth.
Journal of the College of Agriculture, Tokyo, Japan.
Hawaiian Forester and Agriculturist, Honolulu, Territory of Hawaii.
Tropical Agriculturist, Colombo, Ceylon.
Memoirs of the Department of Agriculture, Calcutta, India.
Natal Agricultural Journal, Pietermaritzburg, Natal, South Africa.
Agricultural News, Bridgetown, Barbados.
West Indian Bulletin, Bridgetown, Barbados.
Bulletin of the Department of Agriculture, Kingston, Jamaica.
Journal of the Jamaica Agricultural Society, Kingston.
Journal of the Board of Agriculture of British Guiana, Georgetown.
California Cultivator, Los Angeles, California.
The Rural Californian, Los Angeles, California.
Farmer and Fruit Grower, Jacksonville, Florida.
Louisiana Planter, New Orleans, Louisiana.
Southern Cultivator, Atlanta, Georgia.
Progressive Farmer, Raleigh, North Carolina.
Farmer's Guide, Huntington, Indiana.
Kansas Farmer, Topeka, Kansas.
Farm Press, Chicago, Illinois.
The American Florist, Chicago and New York.
The Feather, Washington, D. C.
The American Thresherman, Madison, Wisconsin.
Oregon Agriculturist, Portland, Oregon.
The Gardeners' Chronicle, London.
Commercial America, Philadelphia, Pennsylvania.
Tropical Life, London, England.
Horn and Hoof, Seattle, Washington.
The Breeders' Gazette, Chicago, Illinois.
The Journal of Tropical Veterinary Science, Calcutta, India.
American Veterinary Review, New York.

REPORTS AND QUOTATIONS.

Crop Reporter, by the Secretary of Agriculture, Washington, D. C.
Monthly Consular and Trade Reports, Washington, D. C.
Federal Reporter, New York, N. Y.
Smith and Schipper's Monthly Report, New York, N. Y.
Hanson and Orth, Hemp Brokers, Monthly Statement, New York.
Hemp Market Report, Landauer & Co., London.
Ide and Christie's Monthly Circular, London.
Exporters and Importers Journal, Chicago, Illinois.
Quarterly Summary of Commerce of the Philippine Islands, Washington, D. C.
Ker & Co's. Price Current, Manila, Iloilo, and Cebu, P. I.
Weekly Shipping Circular (Sugar), Jose T. Figueras, Iloilo, P. I.

LOCAL.

Official Gazette, Manila, P. I.
Far Eastern Review, Manila, P. I.
Philippine Journal of Science, Manila, P. I.
Weather Bureau Bulletins, Manila, P. I.
The Philippine Agricultural Review, Manila, P. I.

SPANISH.

Boletin de la Cámara de Comercio Filipina, Manila, P. I.
Boletin Oficial de la Secretaría de Agricultura, Comercio y Trabajo, Habana, Cuba.
Boletin de Agricultura, San José, Costa Rica.
Hacendado Mexicano, El, Mexico, Mexico.
Hacienda, La, Buffalo, New York.
Industrias Americanas, New York, N. Y.
Agricultor Peruano, El, Lima, Peru.
Prácticas Modernas é Industrias Rurales, La Coruña, Spain.
Resumen de Agricultura, Barcelona, Spain.

OTHER LANGUAGES.

Bulletin de la Chambre de Commerce de Saigon, Saigon, Indo-China.
Bulletin Economique, Hanoi-Haiphong, Indo-China.
Bulletin du Départment de l'Agriculture aux Indes Neerlandaises, Buitenzorg, Java.
L'Agronomie Tropicale, Brussels, Belgium.
Boletim de Agricultura, Sao Paolo, Brazil.
Tamil Journal of South India Agriculture, Madras, India.
Station Agronomique, Port Louis, Colony of Mauritius.
Journal d'Agriculture Tropicale, Paris.
Boletim do Museu Goeldi, Para, Brazil.

THE PUBLICATIONS OF THE BUREAU OF AGRICULTURE.

The following-named bulletins of the Bureau of Agriculture are available for distribution, and will be sent free of charge to any address upon application. Applicants are requested to state whether all publications of the Bureau are desired as issued, or only those specified. The name and address of the applicant should be plainly written and all communications should be addressed to the Director of Agriculture, Manila, Philippine Islands.

FARMERS' BULLETINS.

No. 4. Preliminary Report on Commercial Fibers of the Philippines. (Spanish.)
No. 6. Experimental Work with Fungous Diseases of Grasshoppers. (Spanish.)
No. 9. A few Suggestions on the Cultivation of Cotton. (Spanish.)
No. 11. The Jute Industry. (Spanish.)
No. 12. Abacá. (Manila Hemp.) (English.)
No. 13. The Cultivation of Maguey in the Philippine Islands. (English and Spanish.)
No. 14. The Cultivation of Sesamum in the Philippine Islands. (Spanish.)
No. 15. Tobacco Growing in the Philippines. (English and Spanish.)

PRESS BULLETINS.

No. 6. The Tamarind. (English.)
No. 8. Maguey; Propagating Abacá from Seed; etc. (English.)
No. 9. Agricultural Districts; Control of Rinderpest; etc. (English.)
No. 11. Seed Distribution; Need of Diversified Farming; etc. (English and Spanish.)

POPULAR BULLETINS.

No. 1. Maguey. (English, Spanish, Visayan, Cebuano.)
No. 2. Kapok. (English, Spanish, Tagalog, Visayan, Ilocano, Cebuano.)

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THE PHILIPPINE

Agricultural Review

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EDITORIAL.

TEMPERATURE AND RAINFALL IN AGRICULTURAL DISTRICTS.

In this number of the REVIEW, following the article contributed by the Weather Bureau, "How a Knowledge of the Weather Benefits the Farmer," we are presenting the data giving the temperature and rainfall for each day of the month of July in the principal agricultural districts of the Islands.

As stated in the article above mentioned, it is clear to everyone that the weather has a very important bearing on agriculture and that a knowledge of it is useful to the farmers. The value of such information is, in a measure, demonstrated by the fact that particular sections of the Islands are more successful in raising certain staple crops than others. The great hemp-producing belt of the Philippines corresponds more or less closely to the heavy-rain belt extending along the east coast of the Archipelago; sugar growing is carried on more successfully, or more largely at least, on the Islands of Negros and Panay and in the Pampanga and Agno River Valleys; the production of the best tobacco is confined more or less closely to the Cagayan River Valley and the Province of Union; the coconut industry seems to flourish best on the sandy land along the coasts where there is abundant wind and rain, although it is important that the trees be sheltered from heavy storms, such as baguios or typhoons. The reason for this localization of different kinds of farming is doubtless largely due to the climatic and weather conditions which prevail in the different sections. The question for each individual farmer then is, What are the crops which are adapted to the climatic conditions—temperature and rainfall—that prevail on my farm?

Only as the farmers of the country make a careful study of the climatic conditions under which the different economic or agricultural plants prosper is it possible for them to determine the most favorable conditions for growing the different crops and for securing the best and largest yields. As already indicated it is seen that certain plants do best only where there is a heavy rainfall, while others require only a medium rainfall, and some do well in comparatively dry or arid sections.

With the idea of encouraging and assisting the farmers of the Philippines in the study of the climatic conditions under which their crops must be raised, the REVIEW, with the coöperation of the Weather Bureau, will publish from month to month the data showing the temperature and rainfall for the principal agricultural sections of the country. In this way they may determine in a large measure what crops are best adapted to the climatic conditions of their respective sections and abandon efforts along agricultural lines which can never be a success because of the climatic conditions, as exemplified in the case of the rice-raising experiments of the farmers on the Island of Cebu.

PINEAPPLE GROWING IN THE PHILIPPINES.

In this number of the REVIEW we are presenting an article on pineapple growing in Bataan and Bulacan Provinces by Mr. Mariano M. Cruz, an agricultural assistant of this Bureau. Mr. Cruz has very carefully summarized the status of this industry in the Philippines, which is centralized in the provinces above mentioned.

Attention is called to the careful discussion of this industry under the headings "fiber" and "fruits," leading pineapple districts under which are given the names of some of the principal planters, varieties of fruit raised, methods of cultivation, seasons for planting and harvesting, estimated expense and income from a small plantation, some very pertinent suggestions regarding the selection of plants, proper cultivation and the use of fertilizers, and a comparative survey of pineapple production in other countries.

In this connection attention is invited to "Pineapple Growing in the Far East," under Notes from other Fields, in which it is seen that the output of a single factory in Hozan, Formosa, was 220,000 cans in 1906, 330,000 cans in 1907, and 350,000 cans in 1908. This factory also extracts the fiber from the leaf and uses it in the manufacture of grass cloth. In the Hawaiian Islands the pineapple industry has rapidly developed in the last few years so that Honolulu is said to have the largest pineapple cannery in the world, and the output for this year is estimated at 350,000 cases. The Straits Settlements, which probably has the largest pineapple industry in the world, shipped from Singapore, in 1907, 845,900 cases, valued at ₱3,576,000. The declared exports of these goods to the United States amounted to ₱370,112 in 1906 and ₱1,197,440 in 1907. With such a pineapple industry being developed on every hand there seems to be little reason why capitalists should not invest in such an enterprise in these Islands, which should be as profitable here as in the Straits Settlements, Formosa, or Hawaii.

CONSERVATION OF THE NATURAL RESOURCES OF THE PHILIPPINE ISLANDS.

In connection with the editorial and article in the December number of the REVIEW by the Director of Agriculture, we are glad to present in this number of the REVIEW another article on national conservation, prepared under the direction of Maj. George P. Ahern, Director of Forestry.

It would seem that this subject is, indeed, a very pertinent one for the Insular Government, more especially since we are doing work for another people, who, in the course of time, hope to take over the control of their own affairs. At this time we are reminded of President Taft's declaration, when Governor of the Islands, that one of the fundamental

features of the policy of this Government is "the Philippines for the Filipinos." In this connection also we have the words of Mr. Root before Congress: That the American people are pledged to lead the people of the Philippine Islands on by paths of growing prosperity and capacity for government to the point where they will be capable of supporting and governing themselves. Mr. Root states that it is the bounden duty of the people of the United States to give the people of the Philippines opportunities to grow in habits of industry, in the building up of national pride and national power, and to grow in the accumulation of property and the diffusion of wealth which lies at the foundation of civilization. If these are to be the guiding principles of our work here it would seem that a policy of conservation is emphatically the duty of the Insular Government toward the Filipino people.

In this article Mr. Sterrett gives the origin of the conservation idea in the United States and outlines the opportunities for conservation by the Insular Government. The importance of conservation was repeatedly emphasized by President Roosevelt, and the matter has received enthusiastic indorsement and is being pushed by the people of Hawaii.

Under the opportunities for conservation in the Philippines, it is pointed out that all but a small percentage of the land is held by the Government. It would seem to be clearly the duty of all departments of the Government to provide against and to prohibit the spoliation of the natural resources of these Islands. Forest reserves should be set aside and carefully protected; necessary watersheds should be carefully looked after not only in the interest of the present development of agriculture but for the future progress of the Islands.

Attention is called to the importance of the adoption of a definite conservation policy by the Government in handling the natural resources of the Islands with reference to the welfare of future generations as well as for the best development of these resources at the present time.

The effect of such a policy consciously adopted by the different Bureaus of the Insular Government, as a basic principle influencing their work, would be of inestimable value. Such a policy would serve to unify and correlate the work of all the Bureaus and give the work of each Bureau added significance. It should bring about hearty coöperation in the work of the various Bureaus, which is essential to the proper handling of the natural resources of the Islands. In this age it is conceded by the most progressive governments that the development of natural resources without reference to future production is an uncalled-for waste, and that the most intelligent development of agricultural or forest resources will not only secure the best returns for present generations but will result in even larger returns for future generations.

AGRICULTURE IN JAPAN.

The leading article in this number of the REVIEW is by Mr. Frank G. Carpenter, a writer of national reputation, on "Agriculture in Japan." Doubtless not a few of our readers are admirers of the progress made by the Japanese people. In this connection attention is invited to the activity of the people, the great resources of the Japanese Empire, and more especially the agricultural productions of the country. No one who has visited Japan can fail to admire the cleanliness, good cheer, thrift, enterprise, and energy of the Japanese people. Mr. Carpenter, after spending two months in different parts of the country, gives the following summary of its agricultural productions: 1,000,000 bushels of rye, barley, and wheat; 250,000,000 bushels of rice; 1,000,000 pounds of tobacco; 56,000,000 pounds of silk cocoons, beside the production of buckwheat, millet, beans, indigo, cotton, and hemp. The rice crop alone is estimated at ₱400,000,000 annually. Stock farming is an important feature of agriculture in the Empire; Japan reports 1,000,000 cattle and 1,000,000 horses.

One of the most remarkable features of agriculture in Japan is the close or intensive cultivation practiced by Japanese farmers. Nothing is too small for their attention. The smallest details in the selection, planting, cultivation, and harvesting of various crops receive the attention of the Japanese agriculturists. Often their fields are no larger than bed covers, but every part of them receives the most thoughtful care. Whole families make their living from the cultivation of a hectare of land. What better lesson could there be for the average farmer of the Philippines, who pays little or no attention to the selection of seed, to the methods of planting, cultivation, and harvesting for securing a large yield of the best quality from each crop.

The Japanese farmer, on the contrary, studies to inform himself regarding the selection of seed, the best methods of planting, the best methods of cultivation, and the best manner of harvesting, and is always in the field himself seeing to it that these methods are actually put into practice. Japan, including Formosa, has an area of 161,160 square miles. Of this area only about one-fourth or little over 20,000 square miles, is cultivated, but this cultivated area, while less than one-sixth of the area of the Philippine Islands (127,853 square miles), feeds a population of more than 50,000,000 people, more than one-half of the population of the United States.

We have often called attention to the importance of the rice-raising industry in the Philippine Islands. Mr. Carpenter states that Japan is rich or poor according as the rice crop does well or ill. In time past the royal taxes were paid in rice, and to-day the financiers watch the growth of this crop as the people of the United States watch the growth

of the corn, cotton, and wheat crops. In Japan the ground for the rice crop is prepared during the winter, it is covered with manure, and made level as a floor. In April it is broken up again with hoes or spades and then flooded. It is not too small a thing for the people of Japan to give their attention to individual plants; when one sees a rice plant out of position or not deep enough in the water he will at once reach down and fix it; in this way every rice stalk is made to yield its largest and best product. The Japanese are lovers of nature; a plant fallen down or a tree whose branches are burdened with flowers or fruit receives their immediate attention.

Another important matter for Filipino farmers to note in connection with agriculture in Japan is the wages paid to farm laborers. The average wage paid to a farm hand in Japan is 32 centavos a day for men and 20 centavos a day for women. Men are paid, including board, ₱116 a year, or less than ₱10 a month, and women get about ₱100 a year, or less than ₱8 a month. With all of their wonderful energy and thrift the masses of the people in Japan live on a simple diet of fish, rice, and vegetables the same as the Filipinos. Filipino farm laborers would scorn such a wage as the Japanese receive, and notwithstanding much larger wages are offered in the Philippines there seems to be little or no inclination to work on the part of the masses of the people who have to work for a living, and little or no ambition to make their country productive like Japan—to put it on an independent financial and commercial basis. It is not to be wondered at that Japanese farm laborers are emigrating to Korea and Manchuria.

One of the most interesting features which is immediately noted in connection with agricultural progress in Japan is the amount of money voted by the Imperial Government to educate the people, and to assist them in every way, by establishing elementary agricultural schools, agricultural experiment stations, and agricultural colleges. The fact that Japan has an imperial cattle and horse breeding establishment, a horse administration bureau, two large agricultural colleges, one at Tokyo and one at Saporo, 36 smaller agricultural colleges, special schools for silk culture and tea raising, 200 agricultural experiment stations, and 300 traveling agricultural lectures should be noted by everyone interested in the agricultural development of the Philippines. When the people of the Philippines begin to show an appreciation of the agricultural resources of their country and the Philippine Legislature makes provision for such lines of work it will be possible for the Philippine Bureau of Agriculture to accomplish results comparable with the progress made by the agriculturists of Japan.

Another fact noted by Mr. Carpenter during his study of the work of the agriculturists of Japan is an example of their wonderful energy and industry, namely, their home industries, which are carried on during

the winter months. The farmers, who are busy in the field during the spring, summer, and early autumn, are in the winter months busily engaged in their homes making starch, macaroni, sweets, mats, straw braid, baskets, bags, ropes, raincoats, and straw hats which are used by themselves during the summer season or sold and sent to other parts of the Empire.

Only about one-half of the agriculturists of Japan own their farms, the remainder are tenants or renters. The Imperial Government aims to assist not only the owners but the renters of agricultural lands and for this purpose it has established an agricultural bank, the Hypothec, with a capital ₱10,000,000, which loans out money to farmers' associations and individual farmers upon real estate security. It also gives long time loans payable by installments at a low rate of interest; it issues savings bonds in denominations as low as ₱5 for the encouragement of thrift.

In conclusion, we invite the attention of Filipino farmers to the following statement from the "Annual Return of the Foreign Trade of the Empire of Japan for 1908" as compared with the exports and imports of the Philippine Islands. The imports from the United States in 1888 amounted to 5,500,000 yen, in 1898 to 42,000,000 yen, and in 1908 to 78,000,000 yen. The exports from Japan to the United States amounted in 1888 to 63,000,000 yen, in 1898 to 163,000,000 yen, and in 1908 to 122,000,000 yen. While the exports and imports of the Philippine Islands may not be altogether a correct index of the energy, industry, and progress of the Filipino people, they stand in striking contrast with the exports and imports of the Japanese Empire, which are a good index of the energy, industry, and progress of the people of Japan.[1]

[1] For Japan in 1908 the imports were 435,000,000 yen and the exports 378,888,000 yen. For the Philippine Islands in 1908 the imports were ₱58,372,240 and the exports ₱65,202,144.

SCHOOL GARDENS IN CEYLON.[1]

By C. Drieberg, *Superintendent of School Gardens.*

PURPOSE, MANAGEMENT, AND JUDGING.

[Teachers' Leaflet No. 1 for 1909.]

The following circular, under the three heads (1) Object of school gardens; (2) Conditions under which they are worked; (3) Points in the judging of gardens, is sent for your information and guidance:

1. *Objects of school gardens.*—(*a*) To brighten the surroundings, of the school, and make it what it ought to be; viz, a pleasant resort for the boys and not a bare and unattractive building.

(*b*) To lighten the routine of class work by varying it with outdoor work of a recreative nature.

(*c*) To exemplify order, form, neatness, and good taste in the laying out of the premises.

(*d*) To furnish a field for nature study; i. e., the study of natural objects in their natural surroundings.

(*e*) To serve as object lessons in horticulture; i. e., the cultivation of useful and ornamental plants.

(*f*) To give a practical turn to school life, and provide a training in elementary agricultural science.

(*g*) To serve as centers for the dissemination of seeds and plants and of information concerning them.

(*h*) To be mediums of communication between the agencies that aim at the improvement of agriculture, and the cultivating classes.

(*i*) To induce the cultivator, directly or through the school boys, to take up new and improved products and adopt better methods of cultivation.

(*j*) To awaken in school children a new interest in the cultivation of plants, and instill in them a love of nature, and so reconcile them to a country life and to agricultural pursuits.

(*k*) To encourage school children to establish gardens at their homes.

(*l*) To make school boys take an honest pride in manual labor, and induce a healthy competition among them as well as between one school and another.

[1] From The Tropical Agriculturist, Vol. XXXIII, No. 1, July, 1909.

2. *Conditions under which school gardens are worked.*—(*a*) Any school which presents possibilities for school gardening will be furnished with a stock of implements and supplied with seeds from time to time; where required fencing wire will also be supplied.

(*b*) Garden work should be carried on by the teacher with the help of the monitors and scholars. After setting aside such part of the produce as is required for purposes of propagation the remainder should be divided among the head master, assistant masters, monitors, and boys who have actually assisted in the work of the garden.

(*c*) In the case of produce not actually used as food, and which it is desirable to dispose of with a view to profit, the amount realized is to be entered in the quarterly report form. The revenue from such cultivation will at the end of the year be equally divided, half to go to the head master and half to be devoted to a garden prize fund for the school.

(*d*) Quarterly reports should be furnished in the forms provided.

(*e*) The school gardens will be inspected periodically by the superintendent and his assistants, and prizes will be awarded by the department to teachers who show the best results.

(*f*) A certificate will accompany each prize, setting forth the nature of the award, etc., and certificates of honorable mention will also be awarded to deserving teachers.

3. *Points to be considered in the judging of school gardens.*—(*a*) Area cultivated.

(*b*) Situation and lay of land.

(*c*) Climate and rainfall.

(*d*) Number and variety of plants grown: (I) Economic; (II) ornamental.

(*e*) Laying out.

(*f*) Arrangement of plants and trees.

(*g*) Grouping for effect.

(*h*) Skill in cultivation.

(*i*) Cleanliness of premises.

(*j*) Cultivation in pots, tubs, and boxes.

(*k*) Bowers and arches.

(*l*) Fruit trees.

(*m*) Fences and hedges.

(*n*) Paths and drains.

(*o*) Lawn and playground.

(*p*) Furnishing of reports and returns.

(*q*) School-garden records.

(*r*) Activity and intelligence of scholars.

(*s*) Care of implements.

(*t*) Aptitude and interest shown by teacher.

ILOILO LIVE-STOCK QUARANTINE STATION.

By J. E. NANCE, D. V. M., *Bureau of Agriculture.*

The four buildings for the Iloilo live-stock quarantine station—namely, the general quarantine depot, the hospital for diseased animals, the matadero and storehouse, and superintendent's house, are now practically completed and ready to be used.

This station is located just outside of and across the Iloilo River from the city, on what is known as "La Granja Pequeña," which was in Spanish times an experiment station. The two cattle sheds and the storehouse and matadero are constructed of reënforced concrete, having iron roofs, open sides, and concrete floors with drainage canals. The dwelling for the superintendent is of native material.

Cattle shed No. 1, or the general quarantine building which will be used for animals not showing symptoms of disease, will accommodate from 80 to 100 animals. Cattle shed No. 2, the smaller structure, is for sick animals; it is fitted with stalls and feed boxes and will accommodate 40 cattle. The arrangement of stalls will be a decided convenience in administering medicines and taking of temperatures, whenever it is necessary to do so. The matadero, although not large, will be large enough for slaughtering as many cattle as will be necessary during a period of quarantine.

Included in the quarantine station site, are about 7 hectares of land inclosed by a five-wire fence with wood posts about $8\frac{1}{2}$ meters apart. Mexican June corn, Guinea grass, sorghum, and other forage plants have been put out and it is believed that sufficient forage can be grown here to supply the foreign animals while they are undergoing the required quarantine period, which is at least ten days from the time of embarkation.

The importation of cattle and carabaos into Iloilo has been steadily increasing for several years. The following statement will show the number of animals received at this port and the disposition made of them during the past fiscal year.

PLATE II.—HOSPITAL FOR DISEASED ANIMALS, ILOILO LIVE-STOCK QUARANTINE STATION.

Iloilo live-stock report for fiscal year ending June 30, 1906.

Kind.	Received from—			Disposition.					
				Removed.			Slaughtered.		
	Philippine Island ports.	Foreign ports.	Total.	Native.	Imported.	Total.	Native.	Imported.	Total.
Cattle	1,507	509	2,016	361	117	478	1,120	325	1,445
Carabaos	1,[illegible]	[illegible]	[illegible]	1,[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Horses	434		434	142		142			
Hogs	8,855		8,855	29		29	8,155		8,155
Sheep	592		592	42		42	550		550
Goats	336		336	67		67	550		550

Infected or diseased animals.

	Diseased on arrival.		Developed disease after arrival.		Infected after arrival.		Total diseased.	Deaths from disease.	
	Native.	Imported.	Native.	Imported.	Native.	Imported.		Native.	Imported.
Cattle		118	2	21	118		259	27	5
Carabaos		39	9	12	49	30	139	33	30

It is expected that the present fiscal year will see double the number of cattle handled as compared with the year just closed.

At times, in their eagerness to purchase carabaos, the *hacenderos* have not always been careful enough in selecting them, and some unscrupulous dealers have sold animals which were diseased or had been exposed to some disease, thus exposing all the animals on the place to which they were taken. This danger will now be obviated, as no such animal will be allowed to leave the station.

The greater part of the imported animals come here from French Indo-China and from British North Borneo. As they are in transit from six to eight days, as a rule, the quarantine period on land is short, provided no symptom of disease develops, and as the care and keeping of the animals will be done at actual cost the importer will have much less trouble, besides having a clean, comfortable, sanitary place to keep his stock.

It is the opinion of men competent to judge in such matters that the establishment of this quarantine station will do much to protect the animals already here and safeguard the health of those that come in the future.

THE CULTURE OF YLANG-YLANG.[1]

DEVELOPMENT IN RÉUNION AND COCHIN CHINA.

Our readers may have noted in the last statistical tables of our valued collaborator, Mr. G. Ernst, that Réunion has now won recognition among the Ylang-ylang-producing countries. The distillers of Manila and Java will have henceforth to reckon with this new source of supply, for it is now an established fact that this tree prospers remarkably in the lowlands of Réunion and furnishes, in economic quantities, an essence equal to the best quality obtained in the Philippines.

MARKET CONDITIONS.

In order to reply in the most adequate manner to the inquiries that have been addressed to us regarding the present market conditions of the essence of ylang-ylang, we have sought information from the most competent industrial and commercial experts. First, Mr. Roure-Bertrand Fils, the able manager of the important firm at Grasse, France, gives, in a letter dated May 14, 1908, the following opinion:

> Considerable quantities are beginning to arrive in the different markets from Réunion. We have had occasion to examine samples to the value of 450 or 500 francs, and in our opinion this essence is at least equal, if not superior, to that furnished by the Philippines, to which it bids fair to become a formidable rival. The shipments being made by post, it is very difficult to ascertain the figures regarding the importation into Europe.

With equal courtesy, Messrs. Schimmel & Co., of Miltitz, France, to whom we frequently apply for reliable information, have communicated with us as follows:

> It is certain that the ylang-ylang met with in commerce is distilled principally in the Philippines[2] and in Java, and other countries are scarcely heard of in this connection. The present value of the very finest quality is about 5,000 francs per kilogram, while the medium quality scarcely exceeds 300 francs. The present production largely suffices for the demand, more especially since many perfumers and soap manufacturers prefer our synthetic essence of ylang-ylang, which is finer and more marketable.[3]

[1] Translated from Journal D'Agriculture Tropicale, June, 1908.

[2] The value of the exports of this product were $15,930 in 1900, $46,296 in 1901, $63,270 in 1902, and $123,182 in 1903.

[3] This artificial product has already been discussed in No. 17 of the Journal d'Agriculture Tropicale, where it was seen that its influence on the market price of the natural product has not been very great.

In a more recent letter (May 30, 1908), Messrs. Schimmel call our attention to a passage in the Diplomatic and Consular Reports (No. 3973, April, 1908), which we here reproduce:

Two hundred liters of essence have been sold by Réunion dealers at an average price of 500 francs per liter. Many new plantations of ylang-ylang have been set out, and it is estimated that in three or four years the production will increase to 400 or 500 liters per year. The planters undoubtedly realize a very good profit at present, but it is to be feared that, as in the case of vanilla, an overproduction will lead to a fall in price.

PRODUCTION OF DIFFERENT COUNTRIES.

We find in the Bulletin Commercial of Réunion that the total exportation of essence amounts at the present time to only 279 kilograms. The importance and the value of the ylang-ylang cultivation in Réunion being thus established, we shall discuss what has been undertaken in other places.

In Jamaica there was an attempt, without very conclusive results, to distill the flowers of the trees which were cultivated in Hope Gardens. The details of this experiment, which does not seem to have been repeated since then, may be found in No. 52 of the Journal d'Agriculture Tropicale, 1905.

In Indo-China ylang-ylang is widely cultivated as an ornamental tree, but up to the present it does not seem to have been exploited for its perfume. Some cultural enterprises in Cochin China have been noted in a United States consular report (April, 1908), in which we read:

The plantation of ylang-ylang lies in the Province of Bienhoa, where the first results are encouraging. The present high price of the essence renders this culture very remunerative. It is estimated by the planters that a hectare planted with 600 trees will produce 6,500 kilos of flowers, which when distilled will furnish at least 16 kilos of essence.[1]

In India attention has been drawn to ylang-ylang by the exhibition, at Kuaal Kangsar, of a sample of essence from the estate of Pula Daat, in Labuan. It was after a long sojourn in the Philippines that the director of Pula Daat undertook the extensive cultivation of this plant. He hopes this year to distill a considerable quantity for market. (Supplement to the Tropical Agriculturist, September, 1907.)

We have thus found that ylang-ylang is cultivated under excellent economic conditions in Réunion, and that the area planted to it is extending rapidly there as well as in Cochin China and English India.

THE CULTIVATION.

Useful information regarding the culture of this plant will be found in No. 17 of the Journal d'Agriculture Tropicale, and more recent documents enable us to add to this, now that the subject is again attracting attention.

[1] Mr. Martin de Flacourt estimates that in Réunion 1 hectare planted in ylang-ylang will yield about 4 kilograms of essence. (N. d. l. R.)

Botany.—The botanical species which furnishes the essence of ylang-ylang is *Cananga odorata* Hook F. and Thoms, more or less widely distributed throughout southern Asia. It appears that it is incorrect to distinguish, as is often done, between this species and *Unona odorata* Dun., which is identical with it. *Unona odorotissima* Steud, on the other hand, is the same as *Artabotrys odoratissimus* R. Br., a species that differs absolutely from *Cananga,* both in its general characteristics and the inferiority of its product. It is important in cultivation to plant *Cananga odorata,* which is easily distinguished from *Artabotrys* by its distichous arrangement and more herbaceous appearance, recalling by these characteristics "anone cœur-de-boeuf" (*Anona reticulata*), and finally by its large flowers which grow only in groups of two or three.

In the specimens of this plant at the museum, examined by the late L. Pierre, a botanist whose work the Journal d'Agriculture has published, the identification is absolute between *Cananga odorata* and *Unona odorata*. If there exists a difference in the value of the essence produced, as Mr. Guerlain, the great Parisian perfumer, has indicated to us, it can only be attributed to physiological differences.

The culture of *Cananga odorata* in Réunion has been described explicitly by Mr. Martin de Flacourt in an article published by the Journal Officiel de Madagascar, March 19, 1904. According to this author the tree had been grown in Madagascar a long time, when a planter of Saint-Paul decided to submit some flowers for distillation, and the excellent quality of the essence was revealed. This was the beginning of methodical cultivation.

Climate.—Ylang-ylang requires a warm and even climate, soil that is rich, permeable, and healthy, and in Réunion it will not flower at an altitude of more than 400 meters.

Methods of reproduction.—The plant multiplies by means of seeds, which may either be planted directly in place, or in well-drained seed boxes and later transplanted. The seeds are taken from the fruit when it is perfectly ripe, and washed to free them from the sugary pulp which would attract ants and result in irregularities in germination. The plants sprout in from forty to sixty days, being sprinkled twice a day. After the plans are a month old they are transplanted into a shaded nursery and spaced at 20 centimeters, or, as is preferable, placed separately in cornucopias made of the leaves of *Pandanus utilis* to serve as flowerpots, or in bamboo pots which are protected by shelters made of palm leaves. The sprinklings are continued as before, and in two months the young trees are 25 or 30 centimeters high, and worth 40 francs per thousand, pots included.

Planting.—The permanent planting is made on clean ground, the trees are placed 4 or 5 meters apart, in holes 50 centimeters in diameter three-quarters filled with vegetable mold or manure and good earth. By fol-

lowing this scheme of planting five or six hundred trees can be planted to a hectare.

During the first years, it will be found necessary to keep the soil clean between the trees. The crops that can be raised in this way will more than pay for the trouble. In order to encourage the growth of the lateral branches, and by this means produce flowers that are more accessible, the trees are topped at a height of $2\frac{1}{2}$ or 3 meters.

In the third year there may be a crop of flowers that will bring 150 or 200 francs per hectare. This return will increase rapidly, and the period of full bearing will last eight or ten years.

GATHERING THE FLOWERS.

In Réunion the harvest lasts from May to September. The work is done by women and children, who are careful to detach only full-blown flowers, and those of a clear yellow color. At the height of the flowering season the trees are gone over every two or three days, and the process of distillation can go on almost without interruption. Fresh flowers give the best essence.

Under these conditions, says M. Martin de Flacourt, 1 hectare regularly planted should furnish 3 or 4 kilograms of essence per year, estimating that from 50 to 64 kilograms of fresh flowers will yield 1 kilogram of essence. The cost of distilling varies with the country, depending upon the equipment in use, the price of labor, and the cost of fuel. The price, fixed at 22 to 30 francs per kilogram of essence for Réunion, rises to 20 francs per pound in the Philippines, and 4 francs 65 centimes per ounce in Jamaica.

In Manila, the distillers, who are all Germans, buy the flowers from the native inhabitants at the rate of from 1 franc to 1 franc 50 centimes per pound. The picking is brought in the morning in order to subject the flowers to the vapor as early in the day as possible. In the period from July to December the trees furnish the best product, often averaging 100 pounds of flowers to the tree. It requires from 80 to 200 pounds of flowers to make 1 pound of essence.

Under present market conditions the raising of ylang-ylang of a superior quality would be remunerative, even though the yield might not exceed 3 or 4 kilograms per hectare. But it would be necessary to consider, before setting out new plantations, that this product is one for which the market is rather limited, that the synthetic essence is to to be reckoned with, and that there are many young plantations that are coming on to increase the present supply of the market. These facts demand serious consideration, especially when it is a question of undertaking the culture on a large scale.

THE LAW PROVIDING FOR A SUGAR-TESTING LABORATORY IN ILOILO.[1]

By authority of the United States, be it enacted by the Philippine Legislature, that:

SECTION 1. The Secretary of the Interior is hereby authorized to establish a sugar-testing laboratory in the city of Iloilo, Province of Iloilo, which shall be in charge of a sugar chemist who shall be an employee of the Bureau of Science. This sugar chemist shall fix and establish, on or before the fifteenth day of November of each year, standard samples of sugars number one, number two, number three, superior damp, and current of Iloilo, which shall govern as hereinafter provided during the twelve months immediately following said fifteenth of November.

SEC. 2. In fixing and establishing these samples, the sugar chemist shall take into account the degrees of polarization, the color, the hygrometric state, the granulation and the crystallization of the samples of each of the several classes of sugar fixed and established by the merchants of Iloilo, and accepted in the markets where Philippine sugar is sold, so far as they are known to him. Merchants may send portions of the classified samples of sugar which they receive from markets in which Philippine sugar is sold to aid him in correctly fixing and establishing standard samples, but failure to receive such samples from merchants shall not operate to prevent the sugar chemist from fixing and establishing standard samples of the different classes of sugar.

SEC. 3. It shall further be the duty of the sugar chemist to correctly classify all samples of sugar that may be delivered to the sugar-testing laboratory for classification by any person. In cases of dispute between contracting parties with respect to the classification of any sugar, any one of them may send to the sugar-testing laboratory a sample of the said sugar for its classification. The result of the classification made by the sugar chemist shall be set forth in a certified report which shall be transmitted in each case to the person sending the sample. A suitable portion of each sample of sugar, the classification of which shall have been thus fixed, shall be deposited in a glass container which shall be closed with sealing wax, on which shall be stamped the seal of the

[1] Act No. 1896, Philippine Legislature.)

Bureau of Science, and shall be properly marked so that it can be identified, and shall be transmitted to the person sending the sample.

SEC. 4. In every case of dispute between contracting parties as to the class of sugar, a classification made by the sugar chemist, as provided in section three of this Act, shall determine the classification of the sugar in question, except when any one of the parties shall impugn the classification made by the sugar chemist and shall prove that it is incorrect.

SEC. 5. Subject to the approval of the Secretary of the Interior, the Director of the Bureau of Science is hereby authorized to fix charges for the determination of the degrees of polarization of sugar, and for the determination of its color, its hygrometric state, its granulation and its crystallization, provided that the charges so fixed shall not exceed the actual cost to the Government of performing the work.

SEC. 6. The sugar chemist may make analyses of sugar canes, of bagasse, or of mill juices, or other similar chemical investigations for private persons. The scale of charges for all such work shall be fixed by the Director of the Bureau of Science, with the approval of the Secretary of the Interior.

SEC. 7. The sugar chemist may carry on such investigations as may be practicable relative to means which may advantageously be employed in improving the quality of Philippine sugar, and the Director of the Bureau of Science shall from time to time publish the results of such investigations for the benefit of sugar producers.

SEC. 8. Payment for all work performed at the sugar-testing laboratory shall be made to the sugar chemist, and all sums received in payment for work therein performed shall be accounted for as cash receipts of the Bureau of Science, under such rules as the Insular Auditor may prescribe.

SEC. 9. This Act shall take effect on July first, nineteen hundred and nine.

Enacted, May 17, 1909.

PINEAPPLE GROWING IN BATAAN AND BULACAN PROVINCES.

By MARIANO M. CRUZ, *Agricultural Assistant.*

The pineapple (*Ananassa sativa* Lindl.) has never been, and is not as yet, commercially grown in the Philippines. It is true that it is well adapted to most places in the Archipelago where the soil and climatic conditions are so similar to those of its native place in South America. Unfortunately it is grown only to supply the home consumption of the fruit and the demand for the cloth that is made from its fiber. Of course there is some of this cloth exported annually, but this amounts to only about ₱1,200.

PRODUCTION OF FIBER AND FRUITS.

In 1903 there were in all the Islands about 613 hectares of land devoted to pineapple growing, from which about 952,400 pines and 292,400 kilograms of fiber were taken, giving an average production of 1,500 fruits and 470 kilograms of fiber per hectare. The provinces in which the yield of fiber amounts to 15,000 kilograms or over are grouped, with reference to the amount of fiber produced as follows:

Order.	Provinces.	Area cultivated (hectares).	Fiber produced (kilos).	Average per hectare (kilos).
1	Negros Occidental	41	46,000	1,122
2	Samar	51	30,229	593
3	Bulacan	31	18,400	594
4	Cebu	25	17,296	692
5	Leyte	29	17,086	589
6	Laguna	25	15,772	631
7	Batangas	27	15,114	560

The following table shows the provinces in which the yield of fruits amounts to 20,000 and upward:

Order.	Provinces.	Area cultivated (hectares).	Fruits produced.	Average per hectare (fruits).
1	Samar	51	93,000	1,824
2	Bataan	30	46,620	1,554
3	Negros Occidental	41	44,400	1,083
4	Tayabas and Marinduque	41	42,000	1,024
5	Cebu	25	31,200	1,246
6	Leyte	29	25,700	886
7	Bulacan	31	24,900	803
8	Zambales	12	22,700	1,892
9	Cagayan	17	21,300	1,253

In the Philippines, Luzon stands first in the list of all the pineapple-producing islands, having more than one-half of the total area and fruit production, while it produces about 46 per cent of all of the fiber.

LEADING PINEAPPLE DISTRICTS.

Some time ago, I visited two of the leading pineapple districts in Luzon, namely, the towns of Orion and Bulacan in the Provinces of Bataan and Bulacan, to make a study of the pineapple cultivation in these places. These two provinces being situated near the coast of Manila Bay their most important industry, of course, is fishing. While it is true that fishing is often very profitable, yet it is somewhat uncertain, like gambling, and not all people can depend upon fishing for their living. The leading residents in these places are anxious to find the best means for fully developing their farms. It was suggested to me, owing to the fact that many of the farmers are not able to understand either the Spanish or the English publications of the Bureau of Agriculture that it would be well to hold an occasional convention in the provinces, similar to farmers' institutes in the United States, so that the farmers would be put in direct touch with men trained in the science of agriculture.

The chief agricultural products grown at Orion are, in their order of importance, rice, pineapples, and corn; while in Bulacan they are rice, sugar cane, pineapples, and ylang-ylang; so that, generally speaking, we can classify the pineapple industry as third in rank of all the industries of these two places.

Orion.—In going over Orion, which is the chief pineapple-producing town in Bataan, I found a whole barrio devoted to pineapple growing—that is, the barrio of Damlog situated on the south side of the town—while some other sections of the town, like that on the west, may be equally adapted to the pineapple industry. Since the insurrection in 1896, the barrio of Damlog had been entirely abandoned by the people who once inhabited it, so that the first pineapple plantations which were established there some five scores of years ago by a Spanish military sergeant, are now almost a jungle left to the mercy of wild pigs and rats.

Bulacan.—In the town of Bulacan pineapples are grown principally in the barrios of San Nicolas, Balubad, Tibig, Pitpitan, and Tabang. The conditions here are somewhat different from those in Orion, due to the fact that better care is given to the plantations here where people live nearer to their plantations than the people in Orion. In both places only a few people are opening up new plantations and the old plantations are not cultivated or fertilized as they should be and therefore produce but little each year.

INDIVIDUAL PLANTATIONS.

The size of a pineapple plantation in the places I visited ranges from 10 to 50 ares, giving an average of about 30 ares (0.3 of a hectare) for each plantation. However, each of the principal growers in both provinces, namely, Sr. Mariano Grei y Angeles, Sra. Pelagia Estacia, Sra. Romana Labrador, and Sr. Teodorico Tria in Orion, and Sres. Edeudato Lava, Francisco Fernando, Manuel Catindig, Jorge Tablan, Anastacio Rodriguez, Francisco Baltazar, and Sra. Isidora Serpio in Bulacan, own much larger tracts of pineapple land.

VARIETIES.

The variety of pineapple that is now raised in Orion has a much larger fruit but is not so sweet as the Bulacan variety. In Bataan the leaves are not used for their fiber as is the case in Bulacan, and the Bataan pineapple, that is said to have been introduced from Bulacan, has apparently been producing larger fruits at the expense of the leaves. Another kind sometimes found in Bulacan is a mestizo variety about the size of the red Spanish. The existing varieties of pineapples in the Philipines, including the Marinduque variety, are supposed to have sprung from pineapples that were introduced from South America by the Spaniards more than a hundred years ago.

METHODS OF CULTIVATION.

On examination of the number and kind of plants in the field, we noted that the plants were set out without leaving any space for a pathway between the rows and that after each plant had produced its full number of rattoons, suckers, and slips, it rendered the harvesting of the fruits amongst the thorny leaves a most difficult task for the farmers. During the harvesting they often chop off the dead leaves and the miniature plants above the soil. This of course serves to thin out the plantation; but as these young plants which are left in the ground grow very thick the plantation may again be turned into an impenetrable field before the next year. The fact that only from 40 to 60 per cent of all the plants bear fruit each year shows not only the effect of close planting, where each plant grows at the expense of the other, but also that selection for the most productive mother plants is not well put into practice. The lack of proper selection and cultivation are also evident in that the plants produce fruits of such varying taste and size (from 0.69 to 1.61 kilograms each). However, it is safe to say that the Philippine pineapple is almost free from any pest or disease, save from what is commonly known as "tangleroot." The leaves produced are from 8.34 to 18.07 decimeters long, but it is to be regretted that the fiber from the leaves is not as yet much used for textile purposes. The leaves of plants after maturing their fruit usually produce one or more suckers and not merely become waste but a source of danger from fire. The present

(*a*) (*b*)

PLATE III.—(*a*) PINEAPPLE FRUIT GROWING AT SINGALONG; (*b*) PINEAPPLES GROWING WITHOUT SHADE AT LAMAO.

method of extracting pineapple fiber is merely by scraping the fresh leaves with a sharp knife or a broken piece of glass, leaving the fiber in a clean condition to be dried in the sun.

SEASONS FOR PLANTING AND HARVESTING.

The planting season in the Philippines is during the months of July and August. The young rattoons and suckers are gathered from the old plantations and planted in a clay-loam soil about 5 to 7.5 centimeters deep and from 60 to 80 centimeters apart. At the time of planting such fruit trees as the "lanca" (*Artocarpus integrifolia*), "guayaba" (*Psidium guayara* L.), "santol" (*Sandoricum indicum* L.), "mabolo" (*Diospyros discolor* Willd.) are set out to shade the new plantation. About 40 to 60 per cent of the plants bloom during the months of February and March of their second year of growth, and the fruits are harvested in the months of May, June, and July. In most provinces the fruits are consumed in the locality where they are produced, but in Bataan and Batangas the product is sold to local dealers who in turn ship it to Manila for sale in the raw condition. Commercially speaking, none has yet been prepared or canned for home consumption or for export. The fruits are usually sold without even being graded for size and quality, all of which means a reduction in the selling price.

ESTIMATED EXPENSE AND INCOME.

The following estimate of the expense and the income from a pineapple plantation of 1 hectare was given me by some of the growers. This will give prospective investors an idea of the present cost of production and the annual receipts from 1 hectare of land planted with pineapples.

Expense or capital invested.

1. Average cost of a hectare of land (₱150 to ₱300)	₱225.00
2. Tools, "dulós," a spatula-like bolo, and a bolo	5.00
3. Cost of clearing of brush and timber land	30.00
4. Cost of planting (20,836 suckers), at ₱2 per 1,000	41.67
5. Cost of harvesting 10,417 fruits, at ₱1.50 per 1,000	15.63
6. Taxes (two-eighths of 1 per cent of the land value, for two years	2.36
Total	320.66

INCOME.

From 40 to 60 per cent of the 20,835 plants will produce about 10,400 fruits, which sell at from ₱3 to ₱5 a hundred, giving a total income of at least ₱416 for the first year. This shows that for the first year of production the returns are much greater than the total expense of the capital invested; while for the succeeding years the only expense would be for cultivation and harvesting, which when intelligently carried out with the judicious use of fertilizers would give a continual increase in the income of the grower.

SUGGESTIONS.

With an industry which has received so little attention it would seem proper that some elementary directions be given for the improvement of the Philippine product.

Selection.—We must resort to proper selection or crossing of the individual plants to obtain a greater number of bearing plants, say not less than 80 per cent, to raise larger fruits, not less than 1.38 kilograms, and at the same time a better quality of fruit. Of course to maintain such desirable characteristics we must give the field proper cultivation and use of fertilizers.

Cultivation.—In the way of cultivation, hoeing can be done three or four times a year, enough to stir the surface of the soil around each plant to hold the moisture as well as to kill the weeds. In the first place, a sandy soil should be selected as it is usually free from obnoxious grasses and it forms a desirable bed for the pineapple, owing to its great looseness and porosity. The superflous leaves, rattoons, suckers, and slips should all be destroyed, unless the rattoon or the lowest sucker must be saved to take the place of the mother plant. Good cultivation will act as a remedy to the disease known as "tangleroot" which is characterized by the roots growing round and round the stem or tap root in search of food instead of reaching out into the ground. Of course, to facilitate hoeing and cleaning, an ample space between the plants should be allowed, for instance, about 80 centimeters between the plants in rows about 120 centimeters apart.

Fertilizers.—At the end of a period of about eight years the old plantation must be all cleared out and plowed under with some manure or fertilizer to restore the elements which have been taken from the soil. It has often been said that our soils in the Philippines are very fertile, but "Where does their fertility go to?" It often goes to waste without farmers paying any attention to returning it to the soil. It has been found by scientific agriculturists that an application to the soil of the proper kind of fertilizers containing nitrogen, potassium, and phosphorous in the necessary proportions will improve the fruit or the plant, and sometimes both, and thus increase the market value of the product. It is therefore necessary for Filipino pineapple growers to apply fertilizers to their soils so as to provide them enough of the necessary plant foods for their proper development. Pineapple fields should be given at least two applications of fertilizer each year. The plants should be fertilized the first time immediately after their fruits have been harvested, and again about two months previous to blossoming. The last application should contain a large amount of potash to improve the quality as well as to develop the size of the fruit.

The following composition is taken from Bulletin No. 8 of the Porto Rico agricultural experiment station and shows the necessary elements and the amount of such mixtures which should be used for every

1,000 plants. A sufficient quantity of tobacco dust should be dropped into the heart of each plant; the tobacco serves as an insecticide as well as a fertilizer. The application per 1,000 plants following the harvest should consist of about 19 kilograms of dried blood, 14 kilograms of high-grade sulphate of potash, and 13.34 kilograms of acid phosphate; while the second application may be made of the following combination: 18.4 kilograms tankage, 22.08 kilograms of low-grade sulphate of potash and 5.98 kilograms of basic slag.

Canning factories.—The desire of many people to establish pineapple-canning factories in Manila must be known to the growers so that the latter can be induced to produce fruits of a desirable size and quality for shipping purposes. There is also a demand, from some firms in Manila, for pineapple fiber, and the planter might just as well take advantage of this product which is usually left in the field to decay.

PINEAPPLE PRODUCTION IN OTHER COUNTRIES.

Before closing this article, we must take a glance at the situation in the principal pineapple-growing countries of the world in order to realize the true importance of the industry. Let us look first at the United States and one of her island possessions, Hawaii. The State of Florida produces annually about 15,000,000 fruits; while in Hawaii, where planting of pineapples has just been started, it is estimated that 4,560,000 fruits will be produced in 1910. To take care of this product, Honolulu, the capital of Hawaii, has established a canning factory that is claimed to be the largest in the world, with a capacity for canning about 132,000 fruits every day. At present, Singapore produces the most pineapples, supplying nearly all England and the European Continent with an annual export of about 20,313,424 canned fruits. The variety that is most extensively grown in the places mentioned above is the "red Spanish," while the other varieties raised are the "Abbaschi," "smooth Cayenne," "Porto Rico," and "Natal canning." Some of these varieties are now being tested at the Government experiment stations along with our native varieties. With favorable soils and climatic conditions, with a growing interest and enthusiasm on the part of Filipino farmers and business men for improved methods, we could soon place the Philippines side by side with the places above mentioned, in supplying the world's demand for pines.

CONSERVATION OF THE NATURAL RESOURCES OF THE PHILIPPINE ISLANDS.[1]

IMPORTANCE OF CONSERVATION.

By the conservation idea may be understood a conscious purpose on the part of the Government and the people to economically handle the natural resources so that they be not wasted but rather improved, where possible, in their productivity and usefulness. It is a recognition that all natural resources are more or less of a heritage which we should take care of and properly handle so that posterity will not have to suffer for our lack of foresight. It is an inspiring and patriotic idea—this of living with reference to the welfare of generations yet unborn and for the future greatness and prosperity of the country, as well as for our own immediate wants.

The conservation idea in the United States developed from a realization that the country would be facing a timber famine in about thirty years unless something were done to stop needless waste and to secure new crops of timber where the mature trees were removed. "The forest problem opened the eyes of the people to the condition of our natural resources as a whole. It was seen that our national progress, even our national existence, depends upon reform in our methods of using the natural riches of the land; that it was time to set our national house in order, to take stock of our resources, and to lay plans for their wisest use in the future."[2] It was with this idea in mind that the President called the famous "Conservation Congress" of May, 1908, to which were invited the governors of the States and men of national prominence, familiar from experience in business life with the four great classes of resources—the forest, waters, mines, and the soil.

OPPORTUNITIES FOR CONSERVATION BY THE INSULAR GOVERNMENT.

The opportunities for securing conservation by the Insular Government, or the economic handling of the natural resources of the Philippines, are practically unlimited, as all but a small percentage of the land is held by the Government. The four great classes of resources—the forest, inland waters, mines, and the soil—are all contained in the land, so

[1] Extracts from "Conservation of the Natural Resources of the Philippine Islands," prepared under the direction of George P. Ahern, Director of Forestry by W. D. Sterrett, Forester, Bureau of Forestry; Philippine Education, Vol. VI, No. 1, June, 1909.

[2] Quoted from "A Primer of Conservation," Circular 157, U. S. Forest Service.

that conservation may be considered identical with the proper disposition and use of land public and private.

The Insular Government has the chance of limiting the disposition of public domain to individuals who will properly develop and improve it; while it can reserve land where it is for the best interests of the public at large, as is the case where the land should be held in forest for protection to watersheds and for the continuous supply of timber.

In the States most of the land has passed into the hands of private owners, so that the chances for conservation by the Government there can not be compared with the chances in the Philippines. In the economic development of the States there has been much unnecessary waste. Professor Shaller, a great American geologist and scholar, says: "Of all the sinful wasters of man's inheritance on earth, and all in this regard are sinners, the very worst are the people of America."

In the Philippines the Government has the opportunity to profit by the example of the land policy of the United States by which much of the public domain passed into the hands of unworthy individuals, to be spoiled and impoverished instead of improved and made richer. There are large areas of mountain land in the States which should have always been held by the Government as protective forest, which is now denuded and impoverished waste land.

Conservation work by the Government may be classified under two heads: (*a*) Management of public natural resources; (*b*) educational work to encourage private owners in rational and economic management. In the United States most of the work has to be along the latter lines—as, for example, the work of the Department of Agriculture in promoting scientific farming—as the Government has given away most of the public natural resources.

RELATION OF DIFFERENT BUREAUS OF THE INSULAR GOVERNMENT TO CONSERVATION.

Almost every Bureau of the Insular Government is concerned directly or indirectly with the conservation of the natural resources of the Islands. Conservation, however, as an expressed and influencing idea has as yet little to do with the actual workings of the Bureaus, except in the case of the Bureau of Forestry. The Bureaus whose work is most directly concerned with conservation are Lands, Forestry, Science, Agriculture, and Education.

Bureau of Lands.—This Bureau has charge of the important work of disposing of the public domain in accordance with the laws pertaining to the disposition of Insular lands. It is important to conservation that this work be very carefully carried out and that no public land pass into private hands by fraudulent methods. This Bureau has charge of land-survey and land title work, which should be very strictly executed.

Bureau of Forestry.—This Bureau has control of all public forests,

including the disposal of the timber, and has the permanent control and management of all land which is more valuable for growing timber and for the protection of watersheds than for other purposes. From a conservation standpoint this is the central Bureau of the Government, since the most important work which can be done by the Government in conservation is in holding as public forest reserves, under rational forest management, sufficient land for maintaining a continuous timber supply and for the protection of watersheds. Nothing is more vital to the general welfare of the Islands than the carrying out of a proper forest conservation policy.

Bureaus of Science, Agriculture, and Education.—The work of these Bureaus in the promotion of conservation is along educational lines—education of private owners in economic handling of natural resources—and in the collection and classification of data useful to the Bureaus in charge of public natural resources.

The Bureau of Science is carrying on scientific investigation work along botanical, dendrological, biological, entomological, zoölogical, chemical, and mineral lines which will be of great assistance to private individuals and Government Bureaus in the economic handling and development of the natural resources of the Islands.

The Bureau of Agriculture is promoting the practice of scientific and up-to-date agriculture and is aiding the farmer in the most economic utilization of the resources of the soil.

The Bureau of Education has the work of familiarizing, in the schools, the rising generation with the purposes of conservation, both from ideal and practical standpoints, showing how it is for the welfare of the State and of the individual to practice economy in the handling of natural resources.

The work of most of the Bureaus of the Insular Government bears more or less on conservation. For instance, the Bureau of Constabulary is of great importance in the patrol of public lands and forest reserves to stop trespassing, and in protecting the permanent settler or farmer; the Bureau of Public Works has charge of roads, irrigation, well boring, and other improvements which help in the economic development of natural resources; the work of the Coast Survey and all map work is also important for purposes of locating and taking stock of natural resources.

THE ADOPTION OF A CONSERVATION POLICY BY THE INSULAR GOVERNMENT.

The Government of the Philippine Islands, through its various Bureaus, is handling the natural resources of the Islands in a more or less economic way, but there is not as yet a conscious conservation policy underlying its work which considers the welfare of future generations of almost equal importance to that of the present. It is thought that the conservation idea is of such importance that it should be consciously

adopted by the Insular Government as a basic principle and factor, influencing the work of all its Bureaus. With this end in view the Insular Government should draw up and adopt a definite conservation policy and the work of the different Bureaus should be carried on more or less with the idea of furthering this policy. Such a policy would serve to unify and correlate the work of all the Bureaus and give it added life and meaning. It should prove a source of inspiration to employees in the Government service and tend to arouse an *esprit de corps*. It should bring about hearty coöperation in the work of the various Bureaus, which is essential to the proper handling of the natural resources of the Islands.

SUGGESTIONS AS TO WHAT A CONSERVATION POLICY FOR THE INSULAR GOVERNMENT SHOULD INCLUDE.

The following suggestions are made as to what a conservation policy for the Insular Government should include:

1. A general declaration of principles as to the stand of the Insular Government on conservation, similar to that adopted by the Conservation Congress, as previously quoted in this article.

2. Work of many of the different Bureaus of the Government to be emphasized and outlined more or less with a view to promoting conservation.

(*a*) Bureau of Lands: In the work of this Bureau it is important: That a topographic survey be accomplished as rapidly as possible of the entire Archipelago; that the status of all land be cleared up, and land held by individuals without just title or claim be taken back into the public domain and opened to bona fide homesteaders; that maps showing the exact location of the public domain open to settlement be made; that every effort be made to prevent fraud in the disposition of public domain; that in accordance with new land laws, a more rigid system be carried out in regard to obtaining title to public domain.

(*b*) Bureau of Forestry: The work of this Bureau should be made the main or pivotal work in governmental conservation. The chief work will be in setting aside and managing large areas of public land or permanent forest reserves closed to settlement, for timber and water purposes. There is in addition a large area of forest land which will make excellent agricultural land when cleared, which should be temporarily withdrawn from settlement and managed for the production of timber until the country really needs more land for homestead purposes. There is an abundance of good land without merchantable forest to which there is no just title or claim, which is therefore really public domain, and it is good economy to confine homesteads and settlements to this, until it is all appropriated, and not allow valuable timber to be wasted. The Bureau of Lands has much work to do in the way of determining public domain which is unjustly claimed to the exclusion of new homesteaders. The work of the Bureau of Forestry will include the securing

of the sale and exploitation of mature timber on forest reserves under proper forestry methods, and thereby will derive a large revenue for the Insular Government.

(*c*) Bureau of Science: The work of this Bureau to be directed more or less along lines of investigation which will be most useful from a conservation standpoint.

(*d*) Bureau of Agriculture: Under this Bureau comes the work of agricultural investigation and the promoting of the practice of intensive, scientific agriculture by the farmers.

(*e*) Bureau of Education: The function of this Bureau, from the point of view of conservation, has already been stated.

(*f*) Bureau of Constabulary for policing of forest reserves and protection of farmers.

(*g*) Bureau of Public Works for road work which will facilitate the agricultural development of the country; and the execution of irrigation projects which will increase the area in the Islands which is of value for homesteads.

The work of other Bureaus, besides those discussed, will have more or less bearing on conservation, and their work should be made to facilitate, by helpful coöperation, that of the Bureaus actively engaged in the work.

AGRICULTURE IN JAPAN.[1]

By Frank G. Carpenter.

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During the past two months I have been traveling through the farming districts of Japan. They should be an object lesson to the United States. The country is kept like a garden, and it is as fat as the valley of the Nile. A great part of it, however, is covered with forests, much of it is mountainous, and, all told, the cultivated parts are half as big as the State of Ohio. Nevertheless, this small area is now feeding more than 50,000,000 people, or more than one-half as many as we have in the United States. It produces every year 100,000,000 bushels of rye, barley, and wheat; 250,000,000 bushels of rice, and nearly 100,000,000 pounds of tobacco. It grows 56,000,000 pounds of tea, 10,000,000 bushels of silk cocoons, as well as buckwheat, millet, beans, indigo, cotton, and hemp. The rice crop alone is worth $200,000,000 per annum.

AMONG THE FARMS.

I can give you no idea of the intensive cultivation which is going on here. The whole country is divided up into patches, ranging in size from that of a bed quilt to tracts of an acre or so, and every bit of it is as clean as a Government flower bed. There are no fences, and one looks over a crazy quilt, made up of patches of many-colored crops, bound together with the green grass which forms the boundaries of the fields. The Japanese farms are, on the average, not more than 2 acres in size, and only 15 per cent of all the holdings are of more than 4 acres.

The ownership is widely scattered. There are, altogether, about 8,000,000 families engaged in agriculture, and many of these have their whole living from 2 acres of ground. Others have small tracts of their own and rent more. As it is to-day, only about one-half of the land is worked by the owners. The rest is farmed by tenants who pay a proportion of the crops or high money rents.

But come with me and take a look at the farming country. It is

[1] From the Detroit Free Press, April 4, 1909.

nothing like that of America. There are no barns nor haystacks. There are no big fields and no cattle nor horses. The ordinary Japanese farmer would look upon a Pennsylvania bank barn as a temple, and worship in it if he saw it. He would look upon our sheep as so may wild animals, and a Percheron horse or a Shorthorn cow would be as much out of place on his little tract as the traditional bull in the china shop. This is so, notwithstanding there are something like 2,000,000 cattle and horses in Japan. Most of them, however, are used for freighting or as draft animals to carry goods over the country. They are always kept up and one never sees them roaming about or feeding alone in the fields. The cart is the chief farm vehicle, and it is more often hauled by men or bullocks than by horses.

ALL HAND LABOR.

On the other hand, the American farmer would be lost if he came to Japan. If he brought along a reaping machine, his horses would tramp down his neighbor's crops while turning it around in his fields; and, as for a thrasher, the people would mob him for taking away the work from the laboring classes. He could not use his plows unless he bought up a whole county, and his fences would be useless to say the least. He would be surprised at every step at the methods of good cultivation. He would see wheat, oats, and barley planted in series and transplanted again in rows a hand's breadth apart. He would see these crops weeded as we weed onions, and would eventually see them reaped with sickles close to the ground. After cutting, the straws are laid end by end in little sheaves and tied with a wisp at the bottom. Each sheaf is then pulled apart, and hung over a rope or a pole, like washing, to dry. Later on, the heads of the grain are cut off with a knife, and thrashed out with a flail. In many places the grain is winnowed by throwing it up into the air, and in others the farmers use separators or hand-fanning mills turned by a crank.

The work of preparing the land is quite as hard as the planting and harvesting. Most of the country is dug over again and again every year. It is chopped with mattocks, which have blades 4 or 5 inches wide and as long as your arm. These are so made that the man or woman who uses them must bend double while digging. I have seen women with babies tied to their backs thus working in the rice fields. Their kimonas are tied up over their knees, and they wade through the mud as they set out the plants. I know of no crop which takes so much work as rice, and this is the money crop of Japan. It ranks here as wheat does with us, and Japan is rich or poor according as the rice crop does well or ill. In times past the royal taxes were paid in rice, and to-day the financiers watch the growth of this crop as our people do corn, cotton, and wheat.

THE RICE CROP.

The greater part of the rice crop is raised by irrigation. The fields are made at different levels, and the water from the hills is run by canals from one to the other. The ground is prepared during the winter. It is covered with manure and made as level as the floor. Along about the first of April it is broken up with a hoe or spade and then flooded.

In the meantime the rice plants have been grown from the seeds in nurseries. They are taken up and scattered over the water as needed. Then the men, women, and children of the family tie up their clothes and wade out in the mud. They set the plants out in rows of bunches of four or six plants each. They are so close together that it takes from 1,500 to 3,000 bunches per acre. The water is left on and the rice grows rapidly.

The planting is done about June. The rice soon appears above the water and within a few weeks the whole of the country is a beautiful green. Almost every plant is watched. One sees big-hatted farmers dressed in blue gowns trotting along through the fields. If they see a plant out of shape or not deep enough in the water, they will reach down and fix it. In this way every rice stalk yields its best product.

The harvesting of the rice is even more difficult than harvesting wheat. After the grain is cut, it has to be pulled from the straw and be husked before it can be used. The grains are still in the husks, and the husks have to be taken off before they can be used. This is mostly done by hand, the grains in the shell being put in a mortar and pounded with a wooden pestle until the kernels are free. Some of the farmers have rice mills, worked by water, and others hulling machines, worked by hand. Much of the rice is winnowed by machinery, small hand mills being used.

FAMILIES WORK IN FIELDS.

The Japanese farmers seldom live on their farms. They have little villages of wooden houses, thatched with straw. Here they come at night, and from here they go out in the morning to work. The people generally work in gangs. You seldom see a man alone in the fields. A whole family—father, mother, boys, and girls—all work together. There are many hired hands, and the wages paid are exceedingly small. It is a poor part of the United States where a farm hand is not worth 50 cents a day and his board, or where he gets less than $15 a month, if employed the year round. The wages here, without board, are 16 cents per day for men and 10 cents for women, with much less for children. The work goes on from sunrise to sunset, and it is fully as hard as any on our farms at home. Hands employed by the year receive proportionally less. Including board, men are paid about $58 a year, or less than $5

a month; the women get about $50 or a little more than $4 a month. In a Government report of 1906 I see that men farm laborers were getting less than $20 a year, and women less than $10. There is a steady rise going on in wages of all kinds, and these can not remain as they are.

In some cases, farm laborers hire out to work only on alternate days, devoting themselves to their own little tracts of land during the rest of the week. Boys are often bound out to farmers for terms of from five to seven years, their pay being little more during the time than their board and clothes. Of late, I understand, there has been a considerable movement of the farming classes to the cities, and just now there are many who are emigrating to Korea and Manchuria.

EDUCATING THE FARMERS.

Indeed, the farmers of Japan are rapidly changing. There are public schools everywhere and the boys and girls of the country communities attend them. Nearly every man can read and write, and most of the landholders know what is going on as to scientific cultivation. The Government is doing a great deal along the lines of agricultural education. It has big agricultural colleges at Tokyo and Saporo; and there are thirty-six smaller colleges which are teaching theoretical and practical farming in the towns and prefectures. There are special colleges in Kyoto devoted to the art of silk culture, and instruction is also given in tea raising and in the other specialties of Japan.

The Government has 310 traveling lecturers, who go from town to town and from district to district, preaching advanced agriculture to the farmers and instructing them as to insects, fertilizers, and various crops. Some of these men are present at every agricultural show, and attend also to the experimental farming carried on at the public expense.

Japan has now more than 200 experiment stations, and there are other experiment stations established by the farmers themselves. The first of these stations were organized by men from our Agricultural Department, and there have been many American professors in the colleges. Among the experiment stations is one for the study of the tea plant and of all modes of curing the leaves and preparing them for the market. There is also an imperial silk farm and an imperial cattle and horse-breeding establishment.

STOCK FARMING.

Within the past few years Japan has done a great deal to improve its live stock. It had practically none of much value at the time that Commodore Perry came here. It has now a million cattle and a million horses, and one can buy good beef at all of the ports. When I first came to Japan it was impossible to get anything but tinned butter. There are now numerous dairies, and fresh butter, unsalted, is sold in

most of the cities. The masses of the people use neither butter nor meat. They live upon fish, rice, and vegetables, which they eat with a sauce called *toy*.

JAPANESE HORSES.

The Japanese are doing all they can to improve their horses. The Emperor has a number of studs and horse farms, and his men are importing animals for their improvement every year. He has Arabs, trotters, thoroughbreds, and hackneys, altogether numbering about 500 stallions and mares. There is now a horse administration bureau, which is under the control of the cabinet, with an ex-minister of state as its chief. The business of this bureau is to improve the Japanese stock with the special object of furnishing better animals for the army. I understand that 1,500 stallions of foreign breed are to be purchased and distributed to the chief breeding centers.

At present most of the horses are stocky ponies of Mongolian breed. They have been somewhat crossed with Percherons, and as a result they are very strong and hardy. I see some of them hauling enormous loads on carts through the streets of the cities. They are always hitched up singly, and the driver invariably walks, leading the horse.

HOW THE STATE HELPS THE FARMERS.

This country has a live up-to-date department of agriculture. It is associated with the ministry of commerce, and it deals with almost everything that comes out of the soil. It has branches devoted to insect diseases, to fertilizers, and to stock raising. The nation is doing all it can to make two blades of grass grow where one has grown before; and it is trying to open up new areas for cultivation. Japan has been farmed for more than two thousand years, and it is difficult to find much good, unoccupied land. Every available foot seems to be used, but by changing the hills, and more particularly by consolidating the holdings of owners who have small tracts in the same district, much has been done. As it is now, the fields are of all shapes. Here one spreads out like a fan, there one is square, and further on is a triangular patch. The country is made up of patches of all shapes and sizes, but none contains more than an acre or so.

INDUSTRIES CARRIED ON AT HOME.

At present the farming country is overstocked with people, and most of the farmers have some sort of house industry which they carry on while not engaged in cultivating the soil. In this way the winters are not wasted as in our country, and the nation materially adds to its manufactured products. This phase of agriculture is encouraged by the Government.

Here are some of the occupations that the farmers follow during the idle seasons. They make starch, macaroni, jam, and dried fruits. They

manufacture straw braid, mat facing, and the mats used for rearing silkworms. They make baskets of all kinds, bags for charcoal, straw ropes, straw raincoats, and straw hats. In many of their houses weaving goes on, and in some they manufacture silk and paper. Some of them burn charcoal, others make lime, and others refine camphor.

One feature of the Government help is a part of the Japanese banking system. There is one big bank, the Hypothec, with a capital of $5,000,000 which loans out money to farm districts and to farmers' associations and even to individuals upon real estate security. It gives long time loans, payable by installments and at a low rate of interest, and it also issues savings bonds, in denominations as low as $2.50, for the encouragement of thrift.

ESTIMATED COST OF A COCONUT PLANTATION IN THE FEDERATED MALAY STATES.[1]

ESTIMATE FOR OPENING UP AND BRINGING INTO BEARING 500 ACRES.

First year.	Singapore currency.	English currency. £	s.	d.
Felling and clearing, at $10 per acre	$5,000	583	6	8
Draining, at $12 per acre	6,000	700	0	0
Cost of seed (40,000 seeds), at 8 cents each	3,200	373	6	8
Fencing, at $2 per acre	1,000	116	13	4
Lining and planting, at $2 per acre	1,000	116	13	4
Cooly lines	250	29	3	4
Tools	250	29	3	4
Bungalow	1,200	140	0	0
Stationery and postage	50	5	16	8
Medical	50	5	16	8
Premium, at $3 per acre	1,500	175	0	0
Quit-rent, at $1 per acre	500	58	6	8
Weeding, first six months, at $1 per acre per month	3,000	350	0	0
Contingencies	500	58	6	8
Superintendence	3,000	350	0	0
Total	26,500	3,091	13	4
Second year.				
Quit-rent	$500	58	6	8
Weeding	6,000	700	0	0
Superintendence	3,000	350	0	0
Total	9,500	1,108	6	8
Third year.				
Quit-rent	$500	58	6	8
Weeding	4,200	490	0	0
Superintendence	3,000	350	0	0
Suppling	300	35	0	0
Total	8,000	933	6	8
Fourth year.				
Quit-rent	$500	58	6	8
Weeding	3,500	408	6	8
Superintendence	3,000	350	0	0
Total	7,000	816	13	4

Fifth year, $7,000 (£816 13s. 4d.); sixth year, $7,000 (£816 13s. 4d.); seventh year, $7,500 (£875); eighth year, $7,500 (£875).

[1] From Agricultural Bulletin of the Straits and Federated Malay States, Vol. VIII, No. 5, May, 1909.

ESTIMATED RETURNS.

Sixth year, 10 nuts per tree; seventh year, 30 nuts per tree; eighth year and afterwards, 50 nuts per tree.

Value of nuts, $20 (£2 6s 8d.) per 1,000 nuts; 60 trees to the acre.

Profit and Loss.

Year.	Expenditure.				Value of nuts.		Profit on each year.	
	Singapore currency.	English currency.			Singapore currency.	English currency.	Singapore currency.	English currency.
		£	*s.*	*d.*				
First	$26,500	3,091	13	4				
Second	9,500	1,108	6	8				
Third	8,000	933	6	8				
Fourth	7,000	816	13	4				
Fifth	7,000	816	13	4				
Sixth	7,000	816	13	4	$6,000	£700		
Seventh	7,500	875	0	0	18,000	2,100	$10,500	£1,225
Eighth	7,500	875	0	0	30,000	3,500	22,500	2,625
Ninth	7,500	875	0	0	30,000	3,500	22,500	2,625
Tenth	7,500	875	0	0	30,000	3,500	22,500	2,625

Total expenditure in ten years, $95,000 (£11,083 6s. 8d.)

Gross value of produce, $114,000 (£13,300).

Percentage of annual profit to capital expended

Seventh year	17.79
Eighth year	38.12
Ninth year	38.12
Tenth year	38.12

CURRENT NOTES.

THE NEW TARIFF LAW.

President Taft forced the United States Senate committee to recommend the admission, free of duty, from the Philippines of 150,000,000 cigars, 300,000 pounds of wrapper tobacco, 1,500,000 pounds of filler tobacco, and 300,000 tons of sugar annually, and that all other Philippine products except rice shall have free entry.

The President's plan is that the principles of protection shall be applied to the industries of the Islands. This means reciprocal free trade with the Philippines, with a limitation on the amount of sugar and tobacco to be imported annually.

GOVERNMENT GUARANTY OF PHILIPPINE TOBACCO.

Probably one of the best movements for the protection of Philippine tobacco growers and manufacturers is the step taken by the National Government to guard against the introduction of inferior grades of tobacco leaf, cigars, cigarettes, etc., into the United States and thus discredit the product of the Philippine Islands, as was done with Porto Rico tobacco when free trade was granted to that Island.

The Insular Government, acting on the recommendation of the Bureau of Insular Affairs, decided to provide for the careful inspection and grading of all tobacco shipped from the Philippines to the United States, and it is the intention of the Government to allow only the best grades to be exported, or to see that the Philippine product is not placed upon the United States market without being properly graded and labeled so that the people of the United States will know exactly what they are buying.

It is quite likely that with the increased demand for high-grade Philippine tobacco which will result from the opening of the United States market, there will be a tendency on the part of the growers and manufacturers, as well as the Government, to endeavor to produce Philippine leaf of the best quality in greater quantities. The very high tariff on the Sumatra wraper and the unsuitability of the Connecticut leaf for use with Philippine filler will create a demand which must be filled from the tobacco fields of the Islands.

AMBALANGAN-DALIN IRRIGATION PROJECT.

It seems altogether probable that the first irrigation project which will be carried out and completed is the Ambalangan-Dalin irrigation scheme, near the Agno River in the mountains of Pangasinan. At this place a dam can be built which will flood a great part of the upper Pangasinan. Every survey shows an increasing area that can be effectively irrigated in the locality, so that the Government now plans to carry water to approximately 18,000 hectares of rice land. It is expected that the work on this project will begin soon after the rainy season. As is well known, an annual appropriation of ₱750,000 has been provided by law for irrigation work.

HEMP-STRIPPING MACHINES.

Some time ago Manila hemp dealers and those interested in hemp plantations had the privilege of seeing a demonstration of the work done by a very simple and practical hemp-stripping machine which is the invention of Mr. H. H. Behrendt, of New York. The machine, with a gasoline motor of the same class as that used in small motor boats or launches, is very compact and can be easily moved from place to place on plantations, which in this country is a very great convenience, saving the transportation of hemp stalks for considerable distances.

More recently Mr. Molo, an Iligan planter, has given an exhibition of an improved hemp machine for which he claims many superiorities in construction and capacity to properly clean a large amount of hemp per day.

The progress made by different inventors of such machines is decidedly encouraging and without doubt a very satisfactory machine will be placed on the market in the near future. Another item to which attention has already been called is that machine-stripped hemp has a considerably greater tensile strength, which will naturally lead hemp growers to use stripping machines in preference to having their hemp stripped by hand.

TELEPHONE AND TELEGRAPH SERVICE FOR THE ISLAND OF PANAY.

By authority of the Acting Governor-General, the Acting Executive Secretary advertised for sealed proposals for the franchise for a telephone and telegraph system on the Island of Panay. This call for bids closed August 12, and one firm, Messrs. Bryan & Landon, who are operating a similar line in the city of Cebu, was the only bidder. This franchise was provided for by Acts Nos. 1842 and 1916 of the Philippine Legislature. The successful bidder is required to begin operations by installing the said telephone and telegraph lines within eighteen months after the franchise has been granted.

THE SIASI PLANTATION AND TRADING COMPANY.

The site of the Siasi Plantation and Trading Company is about 40 miles south of Jolo, in the Moro Province. This plantation consists of 2,500 acres, the limit allowed by law. The company has been working about two years. Its officers are: President and treasurer, Mr. George R. Harvey, Solicitor-General; vice-president, Mr. Carson Taylor, publisher of the Daily Bulletin; secretary, Dr. H. S. Kneedler, and superintendent, Mr. N. M. Holmes.

About 250 acres of this plantation have been planted to rubber, coconuts, peanuts, and tapioca. The tapioca and the peanuts are planted between rows of rubber and coconut trees. These plants have done exceedingly well and the first week in August saw the first fruits in the shape of a shipment, received in Manila, of four large sacks of shelled peanuts which were delivered to Mr. M. A. Clarke, and thirty-four sacks of cassava starch which are being sent to New York, San Francisco, and other markets as samples. It is hoped that other plantations of this sort will be started in different agricultural sections.

IRRIGATION WORK IN BULACAN.

One of the largest irrigation works in the Islands is that to be constructed in Norzagaray for the irrigation of over 25,000 hectares of rice land. The water for the system will be drawn from the Angat River; its estimated cost will be about ₱1,200,000. This project, like the Ambalangan-Dalin, is still subject to final action by the Government, but there seems to be little question regarding this phase of the matter providing the people concerned give it their support.

JAVA EXHIBITS FOR THE CARNIVAL.

The officials of the Carnival Association have received a communication from the government officials of Java, through the consul for the Netherlands, P. K. A. Meerkamp van Embden, of this city, in which these gentlemen state that they have received the invitation to participate in the Philippines Carnival and that they will be pleased to send representatives and exhibits of their products, which, of course, will be a prominent feature of the Carnival for 1910.

PROVINCIAL FAIRS AND EXIBITIONS.

The bill providing for the holding of provincial exhibitions of the products of the industry and agriculture of different provinces, which was introduced in the Assembly by Delegates Alvear, Paterno, and Leon Guerrero, was a most commendable move in the right direction. The purpose of such expositions of course is to stimulate the agricultural and industrial development of the provinces. The plan provided for in the bill was that expositions should be held in the different provinces or

groups of adjacent provinces during the first two weeks of April, every six years, beginning in 1911. The only objection to this plan is that it does not provide for holding expositions often enough and there should be no set time at which all provinces should hold expositions, as the time and frequency of such fairs or expositions must be determined in a large measure by the financial condition of the provinces interested and the industrial and agricultural progress made. We hope that this measure will be taken up again at the next meeting of the Legislature and that steps will be taken to not only make it possible, but to encourage the provinces to hold such fairs and expositions.

CIRCLE FOR THE STUDY OF THE SOCIAL AND ECONOMIC CONDITIONS IN THE PHILIPPINES.

During the third week of the meetings of the Teachers' Assembly, meetings were held under the direction of Doctor Barrows in the course of which a circle for the study of social and economic conditions in the Philippines was organized. The "circle" proposes to make original investigations in the conditions surrounding the daily life of the people, to collect data regarding conditions, and to publish the results and conclusions drawn for the information of its members, and especially to provide suitable subject-matter for the study of these subjects in the secondary grades of the public schools. The work is to be carried on under the direction of a central committee.

VILLAGE AND RURAL IMPROVEMENT SOCIETIES.

A series of articles on this subject by the Director of Education is being published in "Philippine Education" for the fourth grades. From the name of the societies we should think that a great deal of good could be accomplished for the improvement of country life by work properly carried on under this heading. It is hoped that the village and rural improvement societies organized in the intermediate schools in the Islands will take up practical subjects and that they will be led, through their supervisors and teachers, to do a great deal toward improving the present conditions of rural and village life. It is earnestly to be hoped that they will not spend their time in talking about history, politics, and government, but that they will take up specific lines of improvement and show the people how better conditions can be brought about and what can be done along various lines to change the existing conditions for better conditions. What we need is action; not merely knowledge, but actual work in some definite direction, which will count for better conditions at once.

MANILA CIGARS FOR THE UNITED STATES.

A single order for 85,000,000 cigars has been placed by a well-known American concern with three of the leading tobacco factories in Manila. It is said that this firm is in an excellent position to push the sale of

Philippine goods throughout the United States. This order includes cigars of all sizes, but mostly those familiar to Army people, which will be put on sale in the United States at 5 cents. A real handmade perfecto for a "nickel," it is believed will appeal to American smokers as a great bargain. Among the brands that have been included are the "José Rizal," and the "Aguinaldo" (a new cigar).

Advertising is being prepared on a large scale to present these tempting offers to the people in the United States. A series of beautiful scenes of life in the Philippines, which it is believed can not fail to attract attention in the States, is being painted by artists who are said to be especially capable along these lines.

ADDITIONAL VETERINARIANS FOR THE BUREAU OF AGRICULTURE.

The Acting Director of the Bureau of Agriculture has cabled to Washington for twelve eligible veterinarians. These men should arrive within the next few months. With these new men the force of veterinarians in the Islands will be increased to 44, 31 more than formerly employed.

In the past the work of the Bureau has been greatly handicapped by the lack of veterinarians, as there were but 13 men for all of the provinces, and five of these were stationed in Manila, Iloilo, and Cebu, leaving but eight veterinarians for all of the provincial work. With but eight men it has been impossible to effectively combat outbreaks of animal diseases. With the force increased to 44 it is believed that the whole Archipelago can be adequately covered so that all animal diseases can be reduced to a minimum and outbreaks of rinderpest can be promptly stamped out.

NOTES FROM OTHER FIELDS.

PINEAPPLE GROWING IN THE FAR EAST.

In the Hawaiian Islands the pineapple growing and canning industry is rapidly extending. The amount of these fruits shipped to the United States in 1908 was valued at ₱1,443,718. The present acreage of pineapple land in Hawaii is estimated at 4,540 acres, from which it was expected to harvest from 350,000 to 400,000 cases for the year ending May 31, 1909.

In Formosa pineapples were formerly grown only for local consumption as the cost of transportation to nonproducing districts was so high as to make it impossible to supply the demand in those sections. Since the construction of the railroad from the north to the south end of the island, the cost of transportation has been so greatly reduced that it is possible to ship the fruits cheaply to all parts of the country. This has so stimulated the production and cultivation of pineapples that it has become a profitable industry, and canneries have been built not only to supply the Formosan trade but for export to other countries. One of the largest canneries was established in 1901 at Hozan. The output of this factory for the last five years has been as follows: 1904, 94,400 cans; 1905, 98,000 cans; 1906, 220,000 cans; 1907, 330,000 cans; 1908, 350,000 cans. This cannery also extracts the fiber from the leaf of the plant and uses it in the manufacture of grass cloth. The fiber extracted amounts to about 75,000 pounds annually.

The largest and most extensive pineapple industry in the Pacific Ocean region is in the Straits Settlements. In 1907, 845,900 cases of preserved pineapples, valued at ₱3,576,000, were shipped from Singapore. The declared exports of these goods to the United States amounted to ₱267,064 in 1905, ₱377,012 in 1906, and ₱1,197,540 in 1907.

RICE RAISING IN FORMOSA.

According to Consul Carl F. Deichman, of Tamsui, Formosa, the island has a land area of more than, 8,800,000 acres. The entire eastern half of the island is a rugged mountainous region, and the total area available for agricultural purposes amounts to 1,618,800 acres, of which approximately one-half, or 788,470 acres, are in rice fields. About 64 per cent of the population is engaged in agricultural pursuits. The total rice production for 1907 amounted to 44,760,430 bushels, valued at ₱44,820,000.

DYESTUFFS FROM MANGROVE TREES.

According to the report of Consul O. H. Baker, of British North Borneo, there is quite a prosperous business carried on in that country in the manufacture of cutch. Cutch is a hard, brown, brittle substance and when broken presents a smooth shining surface like anthracite coal. It is used for tanning leather and for dyeing textiles black or brown. Sandakan has a prosperous cutch factory which produced and exported 830 tons in 1907 and 970 tons in 1908, a part of which went to the United States.

Cutch is made from the bark of mangrove trees, which grow in great abundance in salt marshes, extending inland in various places in North Borneo as far as 125 miles. Fleets of small native boats collect and transport the bark to the factories. The trees after being stripped of the bark are, as a rule, cut down, split and chopped for firewood, loaded into small boats, and exported to Hongkong and other eastern ports. The methods of manufacturing cutch are reviewed in the "Commercial Products of India," by Sir George Watt, a new volume published under the authority of the British Government by John Murray, of London.

Mangrove trees are found in great abundance in the salt marshes in all parts of the Philippines, but so far little has been done toward utilizing the bark for the manufacture of cutch, for which there seems to be a good market.

THE SUMATRA TOBACCO CROP.

According to Consul Henry H. Morgan, of Amsterdam, the crop of Sumatra tobacco for 1908 has turned out to be superior in quality to the crop of the preceding year, which is attributed to the fact that it received much rain, whereas the crop of 1907 was planted and grown during a very dry season. The wet season has caused most of the tobacco to be of a good, ripe character, although some of the crop received too much rain, which resulted in making the leaf of a too light and red color, not suitable for the American market. It is generally believed that not much of the 1908 crop of Sumatra tobacco will be suitable for the American market.

UNITED STATES TOBACCO IN CHINA.

According to the report of Consul Amos P. Wilder, the imports of United States tobacco into China for the year 1907 amounted to 4,239,100 pounds, valued at ₱923,714, as compared with 4,639,467 pounds, valued at ₱1,193,090, in 1906. About one-fourth of the entire quantity of leaf tobacco imported into China goes to the port of Shanghai. This, it is said, is mostly for the British American tobacco factory at that place. With such a large importation of United States tobacco into China it would seem that Philippine tobacco growers should find a larger market for their product in that country.

A REWARD FOR THE EXTERMINATION OF WHITE ANTS.

The government of the Straits Settlements and the Federated Malay States, together with the Planters' Association of Malaya, have offered a reward of £5,000 for the extermination of white ants, *Termes gestrói.* The reward is intended for the destruction of *Termes gestrói* in rubber plantations and not for a mere poison, such as arsenic, corrosive sublimate, or nicotine, which will destroy any insect that happens to be touched by it.

The sole difficulty in exterminating *Termes gestrói* consists in the fact that the main nest lies underground at an unknown spot and from it radiate small tunnels of considerable length by which the termites attack the trees in a plantation. Attempts to destroy them at the point of attack are of little use as the insects can retire underground and begin their attacks on other trees by means of fresh tunnels.

If the government of the Straits Settlements and the Federated Malay States together with the Planters' Association of Malaya succeed in their effort to find a satisfactory method for the extermination of these pests they will be benefactors not only of agriculturists but of practically everyone who resides in the Orient.

PARA DISTRICT RUBBER EXPORTS.

The following statement furnished by Consul George H. Pickerell, of Para, shows the half-yearly exports of rubber from the consular district of Para for the past three calendar years:

Year.	First six months (kilos).	Second six months (kilos).	Total for year (kilos).
1906	20,138,124	14,532,299	34,670,423
1907	23,407,858	14,106,294	37,514,152
1908	22,293,064	15,393,423	37,686,487

A MARKET FOR MATTING.

According to Mr. Harold M. Pitt, matting made in Japan and exported to the United States amounts to approximately ₱6,000,000 annually. This matting is said to be very similar to that made by many Filipinos, and with the use of machinery, such as the Japanese have, there seems to be no reason why the Philippines should not supply this article to the United States and receive the ₱6,000,000 which is now going to the Japanese Empire. Matting exported from Japan to the United States is subject to a heavy duty; with free trade between the Philippines and the United States, Philippine factories should have a great advantage over Japan in supplying this product.

MR. ROOT AND THE PEOPLE OF UNITED STATES.

Mr. Root, when speaking on the tariff bill, properly defined our Philippine policy in proclaiming that—

> The good faith, the good name, the honor of the American people are all pledged to lead the people of the Islands on by paths of growing prosperity and capacity for government to the point where they will be capable of supporting and governing themselves. We can not fulfill that high duty by giving them money, as the Senator from Nevada [Mr. Newlands] would have us do. Gifts of money tend to reduce the independence of individual character. We can not fulfill that duty by making the Islands unsuccessful in business, by retarding and confining their industry. We can fulfill it only by giving to them the opportunities to grow in habits of industry, in the building up of national pride and national power, to grow in the accumulation of property and the diffusion of wealth, lying at the foundation of civilization.[1]

THE NATIONAL WEALTH OF THE UNITED STATES.

Mr. Willet M. Hays, Assistant Secretary of Agriculture of the United States, has been experimenting for years with the best products of plants and animals, and he states that the national wealth can be greatly increased by seeking out, separating, multiplying, and using the best plants and animal products instead of the common kinds. In this way the United States can save two billion pesos annually, and by giving the boys technical industrial training four billion pesos more can be saved.

THE NATIONAL CORN EXPOSITION.

The National Corn Association will hold its Annual Corn Exhibition in Omaha, Nebraska, on December 6, 1909. The National Corn Exposition stands for the betterment of agriculture. The idea of the corn exposition is to promote the raising of the best corn, wheat, rye, barley, oats, and other grains to supply the market demand. Liberal prizes are offered for the various exhibits and different States are offering special trophies. Six trophies are offered for the best grain exhibits. Three of these are new ones which have a money value of from ₱1,800 to ₱4,000. No grower has won a trophy at grain expositions who could not get more than double price for his grain, especially corn, from those who are constantly seeking better seed. Last year the three trophies offered were the Indiana trophy for corn, the Dominguez trophy for corn judging, and the Western Grain Growers' trophy for oats. This year Kansas will offer a trophy for wheat, Colorado one for oats, and Wisconsin one for barley.

[1] From The Outlook, June 26, 1909.

THE NATIONAL IRRIGATION CONGRESS.

Mr. James W. Beardsley, former Director of Public Works, was appointed by the Acting Governor-General to represent the Philippines at the National Irrigation Congress which was held in Spokane, August 5 to 12. Mr. Beardsley has been making extensive investigations of the irrigation projects in Java, India, Egypt, and other countries, and will report on these investigations as well as on the proceedings of the National Irrigation Congress.

THE TOBACCO CROP OF THE UNITED STATES.

The latest returns from Government sources indicate that the tobacco crop of the United States will be the shortest known in many years. The tobacco dealers of the States appear to be greatly alarmed over the outlook. The weather conditions and the troubles which have recently taken place between some of the tobacco growers and the American tobacco trust have both tended to reduce the amount of tobacco produced this year. As a result of the work of the Night Riders many people have not planted their fields, and in some sections of the tobacco country little or nothing has been done toward producing a crop during the past year.

Such a condition in the tobacco-growing sections of the United States should arouse and encourage the tobacco growers and manufacturers in the Philipines, and more specially now that they practically have free trade with the United States.

TUSKEGEE INDUSTRIAL INSTITUTE.

The annual report of Booker T. Washington, head of the negro industrial institute at Tuskegee, Alabama, shows that this school is steadily gaining ground both in the concrete results produced, in the shape of trained students sent forth, and in the esteem of the public, North and South. Booker Washington's idea is not to give the negroes scientific or classical book learning, but to train them in the everyday pursuits of life and to teach them that what is needed in this world is sober, steady-going, industrious, and thrifty men and women. Schools of this type are needed in the Philippines to arouse an interest in the common callings and occupations—to stimulate agricultural and commercial progress amongst the common people.

PHILIPPINE CIGARS IN THE AMERICAN MARKET.

A shipment of about 200,000 Manila cigars from the Tabacalera factory and another consignment of 240,000 cigars shipped from this port in June by the Philippines Company, Limited, are reported to have arrived at San Francisco by the Pacific Mail steamship *Korea* and to have been placed on the market in the United States. Another large shipment of Philippine cigars which left Manila about two months ago by a freighter clearing for New York has now arrived at that port.

PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS, JULY, 1909.

IMPORTS.

Articles.		Units.	Manila.	Cebu.	Iloilo.	Jolo.	Zamboanga.	Balabac.	Davao.	Total.
Rice	Value	Dollars	228,863	124,406	91,246	664,903	5,151	514		1,115,083
	Quantity	Kilos	8,879,568	4,232,557	3,762,845	180,777	160,456	11,840		17,228,043
Beef cattle	Value	Dollars	47,486	1,216	214		85			49,001
	Quantity	Numbers	2,080	50	60		3			2,193
Hogs	Value	Dollars	2							2
	Quantity	Numbers	1							1
Eggs	Value	Dollars	23,977							23,977
	Quantity	Kilos	206,380							206,380
Sugar	Value	Dollars	6,470	1,387	851	586	312	48		9,654
	Quantity	Kilos	97,371	19,419	15,116	9,316	4,767	466		146,455
Coffee	Value	Dollars	13,876	449	894	26	1,186	5		16,436
	Quantity	Kilos	63,758	2,557	4,341	106	4,891	22		75,675
Cacao	Value	Dollars	21,679	2,552	69					24,300
	Quantity	Kilos	88,643	8,518	71					97,232
Raw cotton	Value	Dollars	321							321
	Quantity	Kilos	3,954							3,954

EXPORTS.

Hemp	Value	Dollars	1,164,508	336,451			310			1,501,269
	Quantity	Kilos	11,807,193	3,275,858			4,340			15,087,391
Sugar	Value	Dollars	40,332	8,021	366,894					415,247
	Quantity	Kilos	942,665	184,485	8,852,950					8,980,100
Copra	Value	Dollars	507,092	222,850	15,200	4,237	11,952			761,331
	Quantity	Kilos	7,318,940	2,839,020	202,668	62,727	174,127			10,597,482
Tobacco	Value	Dollars	119,922							119,922
	Quantity	Kilos	830,683							830,683
Cigars	Value	Dollars	101,000							101,000
	Quantity	Thousands	10,739							10,739
Cigarettes	Value	Dollars	1,393							1,393
	Quantity	Thousands	1,399							1,399

AGRICULTURAL CONDITIONS FOR JUNE.

A general survey of the agricultural conditions which have prevailed in the Islands during the last six months will be afforded by the following summary of crop and weather conditions in the Provinces of Albay and Agusan during that period:

At the beginning of the year 1909, the agricultural conditions in both these provinces would have been excellent but for the typhoons which prevailed during the preceding months. Later some unfavorable conditions, such as a lack both of laborers and of work animals, the destruction of some crops by rats, and finally a drought which was quite general, seriously affected the crops in many provinces of the Archipelago.

In Albay: During January and February, rain and wind spoiled the crops in Jovellar, Libon, and Polangi by breaking down the young rice plants in the first two towns and, in the last, the vegetables, which up to this time had presented a fine appearance. The rains very soon gave place to drought, which continued until May, affecting slightly the rice and hemp fields in Calolbon, Pandan, Polangi, Virac, Camalig, and a few other places, but the crops soon recovered and a good harvest was gathered.

Hemp, which is the staple product in Albay, does not seem to have been seriously damaged by the adverse conditions mentioned, and hence Albay was exceptionally fortunate, although the crops in a few municipalities were injured. In February the price of hemp went down to ₱4 per picul and in June of this year the price was ₱5 per picul, the same as in August, 1908. Notwithstanding this, the inhabitants of this province have not been so discouraged as those of other provinces, where they cut down their abaca plants, giving up the industry entirely. Great quantities of this crop are still grown in Albay and statistics for the month of June show that 12,000 piculs were harvested. Corn and coconuts, while of minor importance in this province, have been in good condition during the last six months.

With the exception of rare cases of surra and foot-and-mouth disease reported among horses in Polangi, Libog, and Guinobatan, and the hog cholera in Virac and Malilipot, the condition of the animals is, in general, excellent.

In Agusan: Rice under irrigation at Butuan and Talacogon was damaged by heavy storms and did not recover until harvest time. Then, too, the farmers found themselves without means of plowing their lands, being

short not only of laborers but also of work animals. Work animals were loaned by the owners to their neighbors, but as it was necessary for them to wait until the owners should have finished their own plowing, a great deal of the planting was delayed in this way. When this task was completed, drought came and injured the seedlings, as there was not sufficient water for transplanting. In the month of May, however, abundant rains came on and the young plants began to develop vigorously. They are now in a fairly good condition, although there are many rats to contend with.

In Cabadbaran there were very few rice fields worthy of mention. The hemp industry, which is the most important in this municipality, suffered very much for lack of laborers and still more through the low prices now prevailing. The prices so discouraged the farmers that in many cases they rooted up their hemp plants in order to try other crops. For the same reason, the tilling of abaca has decreased in Butuan and Talacogon, where many fields planted to this crop received no further attention. During the last six months prices have fluctuated between ₱6 and ₱8 per picul in Butuan; ₱4 and ₱7 per picul in Talacogon; and ₱5 and ₱8 per picul in Cabadbaran. Other crops are now in a fairly flourishing condition, except in Butuan, where the cacao trees suffered a little from a malady known as "bugtoc," and some coconut trees from insect pests. The growing of gutta-percha is being developed in this province and the land seems well adapted to its culture. Many trees have already been planted in the municipality of Cabadbaran and are now in excellent condition. Briefly, we can state that the agricultural conditions of the province are fairly good and it is hoped that the showers for the rest of the season will be such as are needed by the growing crops.

During the last six months all the animals in this province have been in excellent condition, no animal diseases have been reported. An epizöotic disease has attacked the fowls, however, causing a large number of deaths.

Rains are now general in all parts of the Islands, and the sowing of rice is in progress in nearly all of the rice-growing districts. An exception to the above is the municipality of MacCrohon, Leyte, where we have been informed many hectares of land are ready for sowing which is still delayed by the absence of rain. In Bagakay, Albay, rice planting was finished during the month of June and in some of the lowlands rice is now being harvested. This is the case in Biñan, Laguna; Inopacan, Leyte; Lacang, Palapag, and Sulat, Samar; Bulusan, Sorsogon; and Gigaquit, Surigao, and the results are fairly satisfactory. In Danao, Cebu, and Dagupan, Pangasinan, rains have been very favorable to all growing crops, which are now presenting a very promising appearance. In Culasi and Patnongon, Antique, and Bauan, Batangas, rice planting began in June and is not yet completed; but in some municipalities, like

Camalig, Albay; San Jose, Antique; and Inopacan, Leyte, the scarcity of work animals prevented the sowing of the seed.

The following extracts from a letter by Dr. David C. Kretzer, of the Bureau of Agriculture, dated August 2, shows the weather conditions in Marinduque on that date:

As a result of frequent rains during July, most of the upland rice fields have been plowed and planted. Nearly all the lowland rice fields have been planted and at this time the prospects are favorable for a good crop. The "hill" clearings have been planted to rice and a straggling crop of corn, which promise a good yield for this method of farming.

Locusts have appeared in several parts of the island, but, so far as I am aware, they have done very little, if any, damage.

In my travels in Marinduque I have not observed any disease of a communicable nature among live stock, with the exception of surra and mange. Surra is aparently subsiding, but with the advent of the rainy season there is a very noticeable increase in the number of biting insects, and the spread of the disease by them is probable.

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES JULY, 1909.

[Temperature and total rainfall for twenty-four hours beginning at 6 a. m. each day.]

Date.	Hemp.				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.						Aparri.		San Fernando.	
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	27.6	0.3	26.2	8.6	26.9	10.2	28.2	0.0	28.4	0.0	28.4	0.0
2	27.4	1.5	26.5	5.1	27.1	0.5	29.2	11.4	28.2	0.0	28.4	6.4
3	28.0	6.9	26.9	2.5	26.4	6.1	28.4	0.0	28.2	0.0	27.9	0.0
4	27.4	30.5	26.3	6.1	25.3	12.7	29.6	0.8	27.4	0.0	28.0	1.0
5	27.3	37.3	25.2	69.6	26.6	0.0	28.4	7.1	28.1	0.0	28.6	0.0
6	25.3	13.5	25.7	17.5	25.7	5.8	27.2	5.3	27.7	0.0	27.6	7.4
7	26.0	15.7	26.2	9.2	25.3	0.3	26.4	10.4	26.6	4.1	27.9	0.0
8	25.0	33.5	26.6	0.0	26.1	14.2	26.7	15.5	27.2	0.0	29.0	0.0
9	26.9	1.8	27.3	0.0	27.0	0.0	26.6	8.1	27.2	9.9	28.6	3.3
10	26.7	17.5	25.5	25.9	27.4	0.0	26.9	7.1	26.9	0.0	26.1	2.0
11	25.0	51.8	25.5	1.6	26.4	7.4	27.9	2.3	27.5	5.6	29.2	18.3
12	24.5	116.8	25.2	45.1	25.9	4.8	27.6	10.9	27.6	37.6	27.4	8.4
13	27.0	0.5	26.0	15.7	27.0	0.0	25.0	41.7	27.2	6.1	24.8	26.4
14	26.2	0.5	26.2	0.0	27.0	0.0	25.6	0.0	26.9	0.5	26.9	0.0
15	26.9	0.5	27.2	0.0	26.9	10.9	27.2	0.0	27.3	0.0	28.6	9.7
16	26.3	53.6	25.8	0.0	25.4	20.1	23.1	6.4	27.2	31.5	26.9	3.3
17	26.2	0.3	27.0	0.0	26.1	0.8	25.8	11.7	27.4	3.8	27.3	3.7
18	26.8	2.5	27.4	99.8	26.3	11.2	27.4	3.8	25.1	6.6	28.3	1.5
19	25.9	4.8	27.5	11.4	26.3	8.4	27.6	0.8	27.4	0.0	28.2	12.2
20	25.0	10.7	26.4	2.0	26.4	0.0	27.8	5.6	28.0	0.0	27.7	4.6
21	25.4	4.1	26.8	0.0	26.9	0.0	27.8	5.8	26.7	6.4	27.1	4.6
22	26.0	7.1	27.2	0.8	26.4	0.0	27.6	1.5	25.9	0.0	27.4	15.5
23	27.4	0.5	27.6	0.0	26.8	5.6	28.0	0.5	26.6	0.0	28.0	7.4
24	26.0	1.8	27.4	1.3	26.8	1.8	28.8	0.0	26.4	48.3	27.9	51.6
25	26.2	11.9	27.1	4.1	26.6	23.9	27.8	0.3	24.8	82.3	27.6	13.3
26	27.0	2.8	28.3	0.0	27.5	18.0	26.4	25.7	24.6	58.7	26.6	48.3
27	27.6	2.3	28.4	2.3	26.6	44.2	25.8	87.1	25.3	48.8	25.4	83.3
28	28.4	1.0	28.9	0.0	27.7	0.5	24.1	60.5	25.4	14.0	24.8	82.8
29		11.7	29.4	0.0	28.2	18.8	24.9	14.5	25.4	68.1	25.2	74.8
30	27.1	2.5	30.0	0.0	26.8	5.1	25.2	3.6	26.9	0.0	25.8	36.3
31	27.9	1.5	28.5	7.4	27.4	0.3	26.8	0.0	27.2	0.0	27.4	0.0

CROPS PLANTED AND HARVESTED AND CONDITION OF SAME TAKEN FROM MONTHLY CROP REPORTS FOR THE MONTH OF JUNE, 1909.

[NOTE.—Attention is invited to the fact that rice should be understood as being in the unhulled state. 75 liters=1 cavan; 63.25 kilos=1 picul; 46 kilos=1 quintal; 11.5 kilos=1 arroba; 0.4047 hectare=1 acre.]

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Area.	Quantity.	Unit.
Agusan (reports from 3 municipalities):		*Hectares.*	*Hectares.*		
Rice	Fair	150	700	67,500	Liters.
Abaca	Good	10	467	177,100	Kilos.
Coconuts	do			12,000	Nuts.
Corn	do	50			
Albay (reports from 13 municipalities):					
Abaca	do	545	10,432	1,200,991	Kilos.
Rice	do	1,148	180	48,000	Liters.
Coconuts	do			20,000	Nuts.
Corn	do	140	57	16,425	Liters.
Ambos Camarines (reports from 27 municipalities):					
Rice	do	716	357	155,250	Do.
Abaca	do	178	4,090	959,756	Kilos.
Coconuts	do			1,164,000	Nuts.
Corn	do	201	171	38,250	Liters.
Antique (reports from 10 municipalities):					
Rice	do	7,042			
Corn	do		285	151,950	Do.
Coconuts	do			34,000	Nuts.
Abaca	do	5	12	3,163	Kilos.
Bataan (reports from 7 municipalities):					
Rice	do			17,625	Liters.
Corn	Fair	642			
Sugar cane	do				
Coconuts	do			3,000	Nuts.
Batangas (reports from 13 municipalities):					
Rice	do	7,703			
Sugar cane	do	670	3	3,416	Kilos.
Corn	do	875			
Abaca	Fair		10	1,645	Do.
Benguet (reports from 9 municipalities):					
Rice	do	16	149	37,200	Liters.
Corn	Good				
Coffee	Fair		20	1,150	Kilos.
Sugar cane	do				
Bohol (reports from 22 municipalities):					
Rice	do	950			
Corn	do	1,352			
Coconuts	Good			1,545,000	Nuts.
Abaca	do	13	260	40,290	Kilos.
Bulacan (reports from 14 municipalities):					
Rice	do	853			
Sugar cane	Fair	25			
Corn	Good	41	137	67,500	Liters.
Tobacco	Fair	25	31	5,750	Kilos.
Cagayan (reports from 13 municipalities):					
Tobacco	do		825	189,750	Do.
Rice	Good	2,516			
Corn	Fair	3,303	470	280,875	Liters.
Sugar cane	Good	687			

Crops planted and harvested and condition of same taken from monthly crop reports for the month of June, 1909—Continued.

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Area.	Quantity.	Unit.
Capiz (reports from 19 municipalities:		*Hectares.*	*Hectares.*		
Rice	Fair	6,684			
Abaca	do	49	87	32,700	Kilos.
Tobacco	do		59	65,412	Do.
Corn	Good	377	111	148,275	Liters.
Cavite (reports from 6 municipalities):					
Rice	do	72	375	281,250	Do.
Corn	Fair	61	10	15,000	Do.
Sugar cane	Good				
Tobacco	do		2	736	Kilos.
Cebu (reports from 30 municipalities):					
Corn	Fair	16,190	269	294,600	Liters.
Coconuts	Good			983,000	Nuts.
Tobacco	Fair	10	4,848	781,356	Kilos.
Sugar cane	Good	23	48	191,774	Do.
Ilocos Norte (reports from 10 municipalities):					
Rice	Good	283			
Corn	do	2,120	91	196,200	Liters.
Maguey	do	35			
Tobacco	Fair		154	144,532	Kilos.
Ilocos Sur (reports from 18 municipalities):					
Rice	Good	914			
Corn	do	223	698	413,925	Liters.
Tobacco	do		131	27,140	Kilos.
Maguey	do	34	160	38,140	Do.
Iloilo (reports from 13 municipalities):					
Rice	do	5,715			
Corn	do	432	230	95,250	Liters.
Sugar cane	do	50	40	2,024	Kilos.
Tobacco	do		31	2,990	Do.
Isabela (reports from 3 municipalities):					
Tobacco	do			2,300	Do.
Corn	do	868			
La Laguna (reports from 12 municipalities):					
Rice	do	1,930	906	1,461,750	Liters.
Abaca	Fair	7	470	164,450	Kilos.
Coconuts	do			4,746,000	Nuts.
Corn	do	18			
La Union (reports from 9 municipalities):					
Rice	Good	295			
Tobacco	do		318	374,808	Kilos.
Sugar cane	do	65			
Corn	do	371			
Lepanto-Bontoc (reports from 16 municipalities):					
Rice	do	252	512	689,175	Liters.
Corn	Fair	39	144	50,550	Do.
Sugar cane	Good	2			
Tobacco	do		30	11,040	Kilos.
Leyte (reports from 15 municipalities):					
Abaca	do	1,034	2,050	535,601	Do.
Rice	do	1,962	200	450,000	Liters.
Corn	do	995	562	915,975	Do.
Coconuts	do			1,273,000	Nuts.
Mindoro (reports from 6 municipalities):					
Rice	Fair	329			
Abaca	Good	22	35	7,590	Kilos.
Coconuts	do			4,000	Nuts.
Corn	Fair	6	56	45,600	Liters.
Misamis (reports from 4 municipalities):					
Rice	Good	200			
Abaca	Fair	18	63	42,378	Kilos.
Coconuts	do			326,000	Nuts.
Corn	do	603	12	5,250	Liters.
Moro (reports from 5 municipalities):					
Rice	Good	93			
Abaca	do		85	56,988	Kilos.
Coconuts	do			33,000	Nuts.
Corn	do	28			

Crops planted and harvested and condition of same taken from monthly crop reports for the month of June, 1909—Continued.

Province and crop.	Condition.	Planted during month.	Harvested during month.		
			Area.	Quantity.	Unit.
Nueva Ecija (reports from 14 municipalities):		*Hectares.*	*Hectares.*		
Rice	Good	1,140			
Corn	do	217			
Sugar cane	do				
Tobacco	do				
Nueva Vizcaya (reports from 4 municipalities):					
Rice	Fair			3,000,000	Liters.
Sugar cane	Good	5			
Corn	do	3			
Occidental Negros (reports from 10 municipalities):					
Sugar cane	do	550	360	575,575	Kilos.
Rice	do	2,110			
Corn	do	130	10	7,500	Liters.
Abaca	Fair	26	50	44,275	Kilos.
Oriental Negros (reports from 15 municipalities):					
Abaca	Good	78	210	139,783	Do.
Rice	do	805			
Corn	Fair	1,645		3,750	Liters.
Sugar cane	do	45	25	110,688	Kilos.
Pampanga (reports from 8 municipalities):					
Rice	Good	303			
Sugar cane	do	25			
Corn	do	70	20	30,000	Liters.
Pangasinan (reports from 32 municipalities):					
Rice	do	7,172			
Coconuts	do			303,000	Nuts.
Corn	do	2,296	1,070	912,000	Liters.
Sugar cane	do	72	117	222,008	Kilos.
Rizal (reports from 12 municipalities):					
Rice	do	70	170	534,000	Liters.
Sugar cane	do	205			
Corn	do	126			
Coconuts	do				
Samar (reports from 23 municipalities):					
Abaca	Fair	325	771	244,714	Kilos.
Rice	do	228	2,520	3,408,825	Liters.
Corn	Good	273	133	20,175	Do.
Sugar cane	do	71	29	33,839	Kilos.
Sorsogon (reports from 15 municipalities):					
Abaca	do	499	3,110	570,262	Do.
Rice	Fair	1,514	2,012	752,100	Liters.
Coconuts	do			250,000	Nuts.
Corn	do	762	60	18,000	Liters.
Surigao (reports from 6 municipalities):					
Abaca	Good	48	185	104,363	Kilos.
Coconuts	do			90,000	Nuts.
Corn	Fair		3	675	Liters.
Rice	Good		1,650	2,109,375	Do.
Tarlac (reports from 10 municipalities):					
Rice	do	5,617			
Sugar cane	Fair	10			
Corn	do	35	50	25,500	Do.
Tobacco	Good	8	10	2,300	Kilos.
Tayabas (reports from 14 municipalities):					
Rice	do	3,363	4	6,000	Liters.
Coconuts	do			1,040,000	Nuts.
Abaca	do	35	313	57,684	Kilos.
Corn	do	127	5	1,500	Liters.
Zambales (reports from 8 municipalities):					
Rice	do	2,357			
Corn	Excellent		15	22,500	Do.
Sugar cane	Good				
Coconuts	do			8,000	Nuts.

RANGE OF PRICES OF PHILIPPINE AGRICULTURAL PRODUCTS.

Highest and lowest prices of rice, abaca, copra, sugar, tobacco, and corn for the month of June, 1909.

NOTE.—75 liters=1 cavan; 63.25 kilos=1 picul: 46 kilos=1 quintal.

Province.	Unhulled rice, per 75 liters.		Abaca, per 63.25 kilos.		Copra, per 63.25 kilos.		Sugar, per 63.25 kilos.		Tobacco, per 46 kilos.		Corn, per 75 liters.	
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.
Agusan	₱3.00	₱2.50	₱8.00	₱5.70	₱7.00	₱7.00					₱1.50	₱1.50
Albay	3.50	2.40	9.50	5.00	7.75	6.25					5.00	2.50
Ambos Camarines	3.50	2.50	9.00	4.00	10.00	3.00	₱5.48	₱4.00			4.50	1.00
Antique	3.18	1.75	22.00	12.00	6.50	5.00	7.50	3.00	₱25.00	₱6.00	2.50	1.50
Bataan	2.75	2.00					6.00	3.50			2.00	2.00
Batangas	4.00	2.50	10.00	6.00			7.00	3.00	8.00	8.00	4.00	2.00
Benguet	8.00	5.00					6.00	4.00			5.00	5.00
Bohol	4.00	3.00	11.00	7.50	9.25	7.00	6.00	4.00	25.00	4.00	4.75	2.50
Bulacan	2.60	2.10					7.00	6.00	18.00	10.00	2.50	2.00
Cagayan	4.50	3.50					7.00	4.00	25.00	5.00	3.00	2.00
Capiz	4.00	2.00	16.00	7.00	8.00	5.00	7.00	7.00	15.00	4.00	3.25	1.25
Cavite	3.25	2.40	12.00	11.00			3.00	3.00	16.00	16.00	2.50	2.00
Cebu	4.50	2.50	20.00	9.00	9.00	5.00	7.50	2.00	30.00	2.50	5.00	3.00
Ilocos Norte	5.00	3.25			5.50	5.50	8.00	2.50	18.00	3.00	3.00	1.00
Ilocos Sur	5.00	2.70					5.00	2.00	25.00	4.00	4.00	1.50
Iloilo	5.00	2.50	16.00	12.00	9.20	5.00	7.12	4.00	25.00	5.00	3.12	2.50
La Laguna	4.00	2.00	12.00	5.00	7.00	5.50	5.00	3.30			3.00	3.00
La Union	3.50	3.50			6.00	6.00	5.00	4.50	7.00	4.00	4.00	4.00
Lepanto-Bontoc	8.00	3.50			10.00	10.00	5.00	4.50	8.00	3.50	5.00	2.50
Leyte	5.00	3.00	11.50	6.00	8.50	3.50	5.50	4.50	25.00	12.00	4.00	2.00
Mindoro	3.00	2.00	9.00	8.00	5.00	5.00					2.50	2.00
Misamis	4.25	3.25	10.50	6.00	8.25	6.75	4.00	4.00	20.00	20.00	4.25	4.00
Moro	3.50	2.25	12.00	8.50	7.50	6.50					2.50	2.50
Nueva Ecija	3.70	1.25					8.00	2.50	20.00	5.00	2.00	1.50
Nueva Viscaya	3.12	2.12							20.00	20.00	2.00	2.00
Occidental Negros	3.12	2.50	11.00	8.00	8.40	6.00	5.50	4.00	35.00	30.00	3.00	2.00
Oriental Negros	5.00	3.00	14.00	6.50	9.50	7.00	5.50	4.00	25.00	5.00	6.00	3.50
Palawan	4.00	3.50	25.00	25.00	5.50	5.50						
Pampanga	2.50	2.00					7.00	6.50			2.00	2.00
Pangasinan	5.30	1.70			7.00	5.00	6.60	4.00	30.00	6.00	5.00	1.50
Rizal	3.00	2.40					7.00	5.00			2.00	2.00
Samar	5.00	1.75	12.50	7.50	8.00	5.00	5.00	5.00	20.00	10.00	3.00	2.00
Sorsogon	3.75	2.00	12.50	5.00	6.75	5.50	4.50	4.00	12.50	10.00	3.00	1.50
Surigao	3.00	1.75	12.50	7.00	7.50	6.00						
Tarlac	4.00	1.50			4.50	4.50	5.00	3.00	7.50	7.00	2.50	1.25
Tayabas	5.00	2.50	10.50	3.00	6.50	4.00	7.00	6.00	7.00	4.00	2.00	2.00
Zambales	5.00	1.60			5.00	5.00	6.00	4.00			2.00	1.50

PERIODICALS IN THE LIBRARY OF THE BUREAU OF AGRICULTURE.

Everyone interested in the study of tropical agriculture is invited to visit the library and make use of these periodicals.

ENGLISH.

GENERAL.

Agricultural Bulletin of the Straits and Federated Malay States, Singapore.
The Queensland Agricultural Journal, Brisbane, Australia.
The Agricultural Gazette, Sydney, New South Wales.
Journal of the Department of Agriculture of Victoria, Melbourne, Australia.
Journal of the Department of Agriculture of Western Australia, Perth.
Journal of the College of Agriculture, Tokyo, Japan.
Hawaiian Forester and Agriculturist, Honolulu, Territory of Hawaii.
Tropical Agriculturist, Colombo, Ceylon.
Memoirs of the Department of Agriculture, Calcutta, India.
Natal Agricultural Journal, Pietermaritzburg, Natal, South Africa.
Agricultural News, Bridgetown, Barbados.
West Indian Bulletin, Bridgetown, Barbados.
Bulletin of the Department of Agriculture, Kingston, Jamaica.
Journal of the Jamaica Agricultural Society, Kingston.
Journal of the Board of Agriculture of British Guiana, Georgetown.
California Cultivator, Los Angeles, California.
The Rural Californian, Los Angeles, California.
Farmer and Fruit Grower, Jacksonville, Florida.
Louisiana Planter, New Orleans, Louisiana.
Southern Cultivator, Atlanta, Georgia.
Progressive Farmer, Raleigh, North Carolina.
Farmer's Guide, Huntington, Indiana.
Kansas Farmer, Topeka, Kansas.
Farm Press, Chicago, Illinois.
The American Florist, Chicago and New York.
The Feather, Washington, D. C.
The American Thresherman, Madison, Wisconsin.
Oregon Agriculturist, Portland, Oregon.
The Gardeners' Chronicle, London.
Commercial America, Philadelphia, Pennsylvania.
Tropical Life, London, England.
Horn and Hoof, Seattle, Washington.
The Breeders' Gazette, Chicago, Illinois.
The Journal of Tropical Veterinary Science, Calcutta, India.
American Veterinary Review, New York.

REPORTS AND QUOTATIONS.

Crop Reporter, by the Secretary of Agriculture, Washington, D. C.
Monthly Consular and Trade Reports, Washington, D. C.
Federal Reporter, New York, N. Y.
Smith and Schipper's Monthly Report, New York, N. Y.
Hanson and Orth, Hemp Brokers, Monthly Statement, New York.
Hemp Market Report, Landauer & Co., London.
Ide and Christie's Monthly Circular, London.
Exporters and Importers Journal, Chicago, Illinois.
Quarterly Summary of Commerce of the Philippine Islands, Washington, D. C.
Ker & Co's. Price Current, Manila, Iloilo, and Cebu, P. I.
Weekly Shipping Circular (Sugar), Jose T. Figueras, Iloilo, P. I.

LOCAL.

Official Gazette, Manila, P. I.
Far Eastern Review, Manila, P. I.
Philippine Journal of Science, Manila, P. I.
Weather Bureau Bulletins, Manila, P. I.
The Philippine Agricultural Review, Manila, P. I.

SPANISH.

Boletin de la Cámara de Comercio Filipina, Manila, P. I.
Boletin Oficial de la Secretaría de Agricultura, Comercio y Trabajo, Habana, Cuba.
Boletin de Agricultura, San José, Costa Rica.
Hacendado Mexicano, El, Mexico, Mexico.
Hacienda, La, Buffalo, New York.
Industrias Americanas, New York, N. Y.
Agricultor Peruano, El, Lima, Peru.
Prácticas Modernas é Industrias Rurales, La Coruña, Spain.
Resumen de Agricultura, Barcelona, Spain.

OTHER LANGUAGES.

Bulletin de la Chambre de Commerce de Saigon, Saigon, Indo-China.
Bulletin Economique, Hanoi-Haiphong, Indo-China.
Bulletin du Départment de l'Agriculture aux Indes Neerlandaises, Buitenzorg, Java.
L'Agronomie Tropicale, Brussels, Belgium.
Boletim de Agricultura, Sao Paolo, Brazil.
Tamil Journal of South India Agriculture, Madras, India.
Station Agronomique, Port Louis, Colony of Mauritius.
Journal d'Agriculture Tropicale, Paris.
Boletim do Museu Goeldi, Para, Brazil.

THE PUBLICATIONS OF THE BUREAU OF AGRICULTURE.

The following-named bulletins of the Bureau of Agriculture are available for distribution, and will be sent free of charge to any address upon application. Applicants are requested to state whether all publications of the Bureau are desired as issued, or only those specified. The name and address of the applicant should be plainly written and all communications should be addressed to the Director of Agriculture, Manila, Philippine Islands.

FARMERS' BULLETINS.

No. 4. Preliminary Report on Commercial Fibers of the Philippines. (Spanish.)
No. 6. Experimental Work with Fungous Diseases of Grasshoppers. (Spanish.)
No. 9. A few Suggestions on the Cultivation of Cotton. (Spanish.)
No. 11. The Jute Industry. (Spanish.)
No. 12. Abacá. (Manila Hemp.) (English.)
No. 13. The Cultivation of Maguey in the Philippine Islands. (English and Spanish.)
No. 14. The Cultivation of Sesamum in the Philippine Islands. (Spanish.)
No. 15. Tobacco Growing in the Philippines. (English and Spanish.)

PRESS BULLETINS.

No. 6. The Tamarind. (English.)
No. 8. Maguey; Propagating Abacá from Seed; etc. (English.)
No. 9. Agricultural Districts; Control of Rinderpest; etc. (English.)
No. 11. Seed Distribution; Need of Diversified Farming; etc. (English and Spanish.)

POPULAR BULLETINS.

No. 1. Maguey. (English, Spanish, Visayan, Cebuano.)
No. 2. Kapok. (English, Spanish, Tagalog, Visayan, Ilocano, Cebuano.)

PLATE I.—GOOD ROADS IN THE PHILIPPINES.

Sibul Springs Road, Bridge No. 4, looking toward San Miguel, Bulacan Province.

THE PHILIPPINE

Agricultural Review

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EDITORIAL.

NEW REGULATIONS REGARDING THE FREE MAILING LIST OF THE PHILIPPINE AGRICULTURAL REVIEW.

Owing to the increased circulation of THE PHILIPPINE AGRICULTURAL REVIEW and the large expense connected with publishing such a magazine, it has been found necessary to carefully revise the free mailing list and to fix specific regulations governing the same which will go into effect January 1, 1910. That all persons interested in the REVIEW may fully understand these regulations in time to avoid having their names taken from the free mailing list, in case they are now receiving it, or to have their names added to the list, in case they desire it and are included by the following provisions, we are at this time publishing the new regulations for the benefit of those concerned.

So far as possible the Bureau of Agriculture desires to reach the following people with THE PHILIPPINE AGRICULTURAL REVIEW:

(1) Every agriculturist in the Islands who raises and sells or exports a considerable quantity of the staple crops in each agricultural district and can intelligently use either the Spanish or the English edition.

(2) The principal dealers, exporters, and importers of agricultural products, when they request it.

(3) Provincial governors, treasurers, and municipal presidents.

(4) Division superintendents of schools and supervising teachers, when they request it.

(5) American and Filipino teachers who are actually carrying on work in school gardening or elementary agriculture.

(6) Students of agriculture in the Agricultural College, the Philippine Normal School, and provincial schools. In every case when native teachers or students request that the REVIEW be sent to them a specific statement is desired from the supervising teacher, principal, or division superintendent of schools who is immediately in charge of the work of the teacher or student making the request, stating that the applicant has made sufficient progress in the study and use of the English language to be able to intelligently read and use the REVIEW.

THE VALUE OF GOOD ROADS.

One of the most interesting and important articles in this number of the REVIEW is the one on "The Value of Good Roads," by Mr. Marcelino Agana, of Tarlac, Tarlac Province. In this article Mr. Agana points out some of the fundamental advantages of good roads to any country as well as their necessity for the prosperity and progress of this country. He shows that they are necessary for peace and good order. Under present conditions the Insular Government maintains good order and is

able to punish outlaws and criminals only by the expenditure of large sums of money because there are no facilities for quickly reaching different parts of the country; it pays exorbitant prices for the transportation of its officials who supervise and direct Government work. In like manner all industries—agriculture, trade, and commerce—suffer because there are but few modern highways in the Islands. He also points out that good roads are necessary for the development of the towns as well as the provinces and the Islands in general. In conclusion he speaks of the work done under the old Spanish road law, also of the road laws now in operation in the United States, and emphasizes the need of similar laws for the building and maintenance of good roads in these Islands as an immediate and absolute necessity for the progress of the country.

Free social intercourse is one of the first necessities of civilized and enlightened human society. The greatest progress and the highest acheivements in education, the sciences, the arts and in all of those things which go to make up the highest type of individual, depend almost entirely upon perfect freedom of social intercourse. On the other hand the necessary means, money, or wealth to pay for the best advantages of training in the schools, the sciences, and the arts must be derived from the everyday occupations of the people, such as farming, carpentry, mechanics, blacksmithing, shoemaking, tailoring, etc. The sale of the products of these industries together with the sale of the other manufactures of a country furnish the financial foundation upon which progress in education, science, and art must be built. *Without such a foundation progress is impossible.*

In America it is estimated that it costs more to haul a ton of wheat from farm to market, than to ship it from New York to Liverpool. Where it costs the American farmer 23 cents to haul a ton over our country roads it costs the English, Belgian, French, or German farmer only from 7 to 9 cents to make the same haul. According to the Interstate Commerce Report the railroads of America haul 265,000,000 tons of farm produce annually. The average haul from farm to market for the whole country is a fraction over 9 miles for each farmer. The ordinary price for hauling a ton of farm produce this distance is about $2; then the cost of hauling the farm produce of the country to market is $530,000,000. As stated above the American farmer pays more than double what the English, Belgian, French, or German farmers pay for the transportation of their farm produce to market. It is, therefore, clear that half this expense, at least $250,000,000 a year, is paid by American farmers for bad roads, which might easily be saved were the country roads of America as good as those of Europe. Taking the waste on haul, the storage at water fronts, and the advanced prices of food as a consequence of bad roads, we have an expense bill of $1,000,000,000

against bad roads for the 80,000,000 population of the United States, from which it will be seen that every man, woman, and child in the country pays $12.50 a year for bad roads. On the other hand it is also clear that when the roads of America have been made equal to those of Europe the American people can have a credit balance of $1,000,000,000 a year more than they now have—which they are at present paying out for transportation as a consequence of the bad roads in the country.

You are a consumer of rice, eggs, and other food products which are produced and prepared in other countries. Much of the rice which you consume is raised in Indo-China, Federated Malay States, or India and is shipped to the Philippines from Hanoi, Saigon, Singapore, or Rangoon. Now let us consider what you pay for the rice alone. *First,* you pay the cost of production by the farmers, i. e., the cost of planting, cultivating, harvesting, and transportation to the principal railroad or steamship lines; *second,* you have to pay the farmer a reasonable profit; *third,* you pay the cost of transportation from the local markets to Hanoi, Saigon, Singapore, or Rangoon and from these points by steamer to Manila; *fourth,* in Manila you pay into the Insular Treasury an import duty on every *cavan* of rice which is imported and not raised on Philippine farms; *fifth,* from Manila you pay for transportation by railroad or steamer, and from railway or steamship points to your own home, by local transportation—carts or animals. In all you pay from two to four or five times the actual cost of production of the rice which you import, which would give an enormous profit to Philippine farmers and transportation companies if this rice were raised in the Islands. This multiplication of the cost of production is the price which you pay for bad roads in your own country. On the other hand you wear cotton, linen, and silk goods, hats, caps, and shoes which are imported from other countries and for all of these articles you pay many times their original cost; the larger part of this increased price which you pay is for transportation—partly in consequence of the bad roads in your country.

It may be difficult for the average citizen of the Philippine Islands to realize or believe the amount he pays for bad roads, but the fact that every man, woman, and child in America pays an average of $12.50 more for the necessaries of life as a consequence of bad roads in America makes it a very interesting problem—one which can be estimated by residents of different communities. *How much do the bad roads in the Philippines cost every man, woman, and child in the increased prices which they pay for the necessaries of life?*

Napoleon has been quoted as saying, "First of all agriculture, then manufactures, and then commerce." In the development of the great West in the United States the first step was the laying of the great trunk lines through the country, then the railroad companies and the settlers built the main roads or highways, and finally came the building up of the

towns and great cities of the West. In the Philippines we believe that the development of agriculture and the building of good roads should go hand in hand. Good roads are almost useless without the development of agriculture; on the other hand, agriculture is helpless without good roads for carrying its products to market.

THE NATIONAL AGRICULTURE APPROPRIATION ACT.

One of the most interesting articles in this number of the REVIEW to those who are interested in the development of agriculture in different parts of the Islands will be the article on the National Agricultural Appropriation Act for 1909–10.

Doctor Allen in discussing the Appropriation Act immediately calls attention to the change from the appropriation for 1908–9 in that instead of being a lump-fund appropriation, as has been the custom of Congress in previous years, a specific amount is set aside for each individual line of work which it is desired to carry on. For example, the Bureau of Entomology of the United States Department of Agriculture for 1908–9 received an appropriation of $158,800 without further restrictions or specifications as to how the money should be used. This year the same Bureau receives specific amounts for investigations of insects affecting deciduous fruits, for insects affecting cereal and forage plants, for insects affecting southern field crops, for forest insects, for insects affecting truck crops and stored products, for bee culture, for insects affecting citrous fruits, and for general investigations.

In like manner specific appropriations were made for the Weather Bureau, the Bureau of Animal Industry, the Bureau of Plant Industry, the Reclamation Service, for the Investigation, handling, grading, and baling of cotton, and for the establishment of standards for the different grades, for the Forest Service, the Bureau of Biological Survey, the Office of Experiment Stations, the Bureau of Chemistry, the Bureau of Soils, the Bureau of Statistics, the Office of Public Roads, the Division of Accounts, the Library, the Division of Publications, the Department of Printing, Binding, etc.

This appropriation Act contains many suggestions which should be decidedly helpful to us in the Philippines. With such an appropriation there can be no question as to the duty of the Department or of its Bureaus—the work each and every branch is expected to accomplish. The increased efficiency as a result of such an appropriation to the Bureau of Agriculture by the Philippine Legislature would be immediately felt by the agriculturists in different parts of the country.

PHILIPPINE POSTAL SAVINGS BANK STATEMENT FOR JUNE, 1909.

FINANCIAL.

Number of banks.

First class	20
Second class	99
Third class	132
Total	251

Number of Accounts.

Opened	457
Closed	247
Gain	210
Open May 31, 1909	8,572
Open June 30, 1909	8,782

Deposits and withdrawals.

	Number.	Amount.
Deposits	2,219	₱181,255.58
Withdrawals	1,245	153,366.05
Gain in deposits		27,889.53
Net deposits May 31, 1909		1,421,069.03
Net deposits June 30, 1909		1,448,958.56

Resources and liabilities.

Resources.		Liabilities.	
Loans secured by banks	₱1,060,000.00	Deposit fund, due depositors	₱1,448,958.56
Bonds, railway	249,515.55	Stamp fund, stamps outstanding	1,533.65
Real estate loans, first mortgages	90,525.00	Interest fund, balance	16,161.14
Cash on hand:			
Postal Savings Banks	25,188.91		
Insular Treasury	41,423.89		
Total	1,466,653.35		1,466,653.35

STATISTICAL.

Nationality of depositors.

Nationality.	Number, May, 1909.	Accounts opened, June.	Accounts closed, June.	Number, June 30, 1909.	Per cent for June.	
					Gain.	Loss.
Americans	3,351	185	155	3,381	0.90	
Filipinos	4,771	230	74	4,927	3.27	
Europeans	213	19	7	225	5.63	
Asiatics	181	18	9	190	4.97	
Total	8,516	452	245	8,723	2.43	
Societies	56	5	2	59	5.36	
Grand total	8,572	457	247	8,782	2.45	

July 1, 1909.

W. T. BEARDSLEY,
Chief Postal Savings Bank.

Approved:
C. M. COTTERMAN, *Director of Posts.*

PRELIMINARY PLANS FOR 1910 CARNIVAL.

By Sam. B. Trissel.

Preparations are now well under way for the next Carnival to be held in Manila, the opening date of which has been set for February 5, and will continue for nine days.

The Carnival management has decided to devote the first four or five days of the Carnival almost exclusively to industrial and agricultural exhibits from the provinces, and it is expected that there will be a very generous response on the part of the provinces.

Hon. Dean C. Worcester, Secretary of the Interior, has been appointed chairman of the committee on provincial exhibits, and as his assistants on this committee he has appointed the following gentlemen: Maj. George P. Ahern, Director of Forestry; Prof. C. M. Conner, Acting Director of Agriculture; Mr. Warren D. Smith, division of mines; Dr. Merton L. Miller, division of ethnology, and Mr. G. M. Nell, chief clerk, Bureau of Science. Mr. Worcester is giving a great deal of his personal attention to the matter, and there is now every prospect that the exhibits will be on a very extensive scale.

On June 12, Acting Governor-General Forbes wrote a letter to all of the provincial governors calling their attention to the industrial and agricultural features of the next Carnival, asking them to take a personal interest in this feature of the Carnival. The letter was as follows:

LETTER OF ACTING GOVERNOR-GENERAL.

Manila, *June 12, 1909.*

Sir: The Philippine Carnival Association has set the date of the opening of the next Carnival at the 5th of February and the Carnival will be open until the night of the 14th, a period of nine days.

The Carnival of 1910 will be different from preceeding Carnivals in the respect that much emphasis will be laid upon the industrial and agricultural exhibits and it is now intended that the first four or five days of the Carnival shall be devoted almost exclusively to the exhibition of the products of different parts of the Islands, exhibitions of animals, and natural resources.

It is hoped that the exhibits attracted to the Carnival next year will form the basis for a permanent exposition and museum of Philippine products and industries which can be so placed that visitors to Manila will be able to form some idea of the economic possibilities of the Islands, which will result in bringing our merchandise to the attention of the markets of the world and result in

economic development. It is hoped that your provincial board will consider the advantages to be derived by your province sufficiently important to justify the appointment of a committee in your province to prepare an exhibit representative of your resources.

Respectfully,

W. CAMERON FORBES,
Acting Governor-General.

To all PROVINCIAL GOVERNORS.

The Philippine Carnival Association has extended an invitation to the Associated Chambers of Commerce of the Pacific Coast to have a large delegation of that body which is to visit China early next year include Manila in their itinerary and arrange to be present during Carnival week. It is believed that this delegation will be present during the festival season; this will mean that the provinces which make exhibits will have an opportunity to present their products to some of the best known and most influential business men in the United States.

AGRICULTURAL CONDITIONS IN THE PROVINCE OF AGUSAN.

By Frederick Johnson, *Provincial Governor.*

The Province of Agusan covers the lower half of the Agusan Valley, the upper third of the Pulangi or Kotabato, some smaller river valleys, and a mountainous territory west of Iligan Bay. In all parts excellent land is open for settlement, but that part of the province which borders on Butuan Bay, being nearest to the commercial centers, must be the first to attract settlers, and for that reason is the only part to which reference is made here.

PRINCIPAL TOWNS.

The land in this district forms practically one alluvial valley, though the three main rivers—the Agusan, the Kabadbaran, and the Tubay—flow through it. Two towns, Butuan and Kabadbaran, are located here—Butuan 4½ miles up the Agusan and Kabadbaran on the coast. The Coast Guard cutters make biweekly trips to both towns, going up the river to Butuan, and connect them with Iloilo, Cebu, and Tacloban. Commercial steamers touch at both ports, six steamers making regular trading trips, weekly or biweekly. There are several minor barrios on the coast.

The town of Butuan maintains itself largely by the trade from the upper Agusan, but the inhabitants also own hemp plantations along the river banks and relatively large rice fields in the lower delta. Land is open for settlement within a couple of hundred yards of the municipal building of Butuan. It is covered with thin forest growth, most of it evidently having been cleared some time or other, though it is public property. It is mostly rice land and rather swampy, so that carabaos and a rather large capital are necessary for its development; consequently it is not being taken up for settlement.

KABADBARAN-BUTUAN ROAD.

A road has been cut through the forest from the town of Kabadbaran to Butuan, a distance of 17½ miles. For more than 16 miles the land is of the finest in the Archipelago. Three miles of the road run through occupied land; 1½ miles, those nearest to Butuan, run through swamp lands not at present desirable for settlement. In three places navigable

streams connect the road with the coast or the main river. By navigable I mean navigable for large *barotos* or small launches. No point on the road is 4 miles from the coast or main river. No point is 9 miles from a commercial town. Bridges are being put in along the road, and the work of grading and surfacing has been commenced.

SOIL, RAINFALL, AND CROPS.

The soil is black loam, many feet deep, on gravel or clay bottom, and it is not subject to inundation. Throughout it is suitable for hemp, or indeed any other crop. Coconuts, hemp, rubber, coffee, cacao, tobacco, ylang-ylang, sugar, maize, and other products are grown. Ylang-ylang grows to the extent of being a nuisance. The principal crop is abaca with copra next. Indications tend to show that rubber and copra will be the crops of the future. But with the greater part of the land in forest it is too early to prophesy.

I have seen it stated elsewhere that much hemp is rotting on the stalk. That is hardly correct. Some hemp which has been acquired in remote neighborhoods, mostly through purchases from the aboriginals, will not pay for transportation and is being allowed to rot. More hemp is being harvested now than ever before, though but little is being planted, and everybody is striving to substitute coconuts, rubber, or some other better paying crop for hemp.

Drought is unknown. For years there has not been a single week without rain. The rainy season begins about the latter part of October and lasts until April, but an actual dry season does not exist. As I write this, on the 12th of July, at the height of the dry season, I have to get up and move my table, the rain is pouring in through the roof.

Noting that on 17½ miles of the road above mentioned 61 bridges must be put in besides culverts, the facility for drainage will be readily understood. The best land open at present is within 3 miles of the town of Kabadbaran on a stream navigable for launches connecting a couple of miles down with a large tide-water lagoon forming the best harbor on the northcoast of Mindanao.

LABORERS.

Most of the planters here use Cebu, Iloilo, and Bohol men as laborers. These men are to a large extent imported as road laborers. After the expiration of their contract they are allowed to settle for themselves or go to work for others. Most generally they choose the latter. The importation of labor in this manner will average 500 men per annum for the district mentioned. Many immigrants also arrive from Bohol, Camiguin, and Cebu on their own account. A large number of Manobos earn their living as farm laborers. These are semicivilized and by the casual observer may not be distinguished among the laboring men, from the Visayans, except possibly for being somewhat more docile.

Farm hands earn a maximum of 40 cents per day and food. The common wage is 25 cents and food. The men are fairly efficient and little complaint is heard. The land being within a day's steaming of Cebu, Bohol, and Camiguin the labor question is, comparatively speaking, of minor importance for the planter.

PRICES.

The fall in the hemp prices has of course hurt the planters, but the reason is mostly that during the fat years many of them fell into the temptation to overplant on their capital, counting on taking large profits from their plantations without a corresponding outlay in cleaning. The lesson has been learned. The farmers here are not worried, and without exception feel able to carry things along until other crops have taken the place of hemp. An American plantation of some 50 hectares, of which 30 are in hemp, was started in October, 1906. The total outlay to date has been some ₱5,000, the managing part owner receiving no salary. The plantation is now self-supporting, is paying the manager a fair salary, and extension is being continued *from profits only.*

THE VALUE OF GOOD ROADS.[1]

By Marcelino Agana, *Tarlac, Tarlac.*

EMBLEMS OF PROSPERITY AND PROGRESS.

Good roads are emblems of the prosperity and happiness of a country. Without them no nation can exist, not even a city or town. No matter how large a nation is, its extreme limits are drawn together by means of good roads. Though the Roman Empire in its flourishing period was a vast domain, it was connected by a great network of highways stretching from one corner of the empire to the other, so that there was easy access from the center to the outermost part of the country. With these good roads the Romans, the example of the world, were able to maintain a perfect administration. Almost all economic development waits and depends upon good roads. Civilization progresses with the advance and opening of new roads. They invite and serve as conductors of progress from one part of the country to another. The telegraph, the newspaper, communications by mail, can not fulfill their purpose for the enlightenment and drawing together of men without good roads to give proper distribution to their beneficial offerings. Good roads mean prosperity to commerce. Good roads mean new sources of wealth to the country.

The future destiny of the Philippine Islands depends chiefly upon good roads which are of vital importance to this country and every other. Land transportation is of equal, if not more value, than water transportation. The roads throughout the Islands are usually in a deplorable condition, especially during the rainy season. Transportation is mainly carried on by packers in the mountain regions, and by carabao carts or pack horses in the lowlands. The provinces and towns are often separated by natural boundaries which hinder the development and interchange of commodities and interests. A failure of crops is liable to produce a famine locally, when the neighboring provinces or towns have plenty. The presence of good roads will result in the progress and development of these Islands.

[1] From Philippine Education, Vol. VI, No. 1, June, 1909.

FOR PEACE AND GOOD ORDER.

The presence of outlaws compels the Government to maintain a large military force in order that peace may prevail throughout the Islands. The Bureau of Constabulary spends more money per annum than any other Bureau; this should be spent for the development of agriculture. The extermination of these highwaymen will decrease the military force, and this decrease means a great economy to the Government. The Government is unable to pursue these bandits on account of the absence of good roads. Owing to difficult traveling the Government pays more than it should for sending its officials from town to town. The opening of good roads means both peace and economy to the Government.

FOR AGRICULTURAL DEVELOPMENT.

Agriculture depends largely upon good roads, which is the country's most important resource for revenue. A great majority of the inhabitants are engaged in the cultivation of rice, hemp, sugar cane, corn, etc., the first being the chief food of the people. Strange to say, so fertile a country as this is, is at present unable to supply all of its inhabitants with a sufficient quantity of rice for home consumption; but this must be imported yearly from other countries less fertile. This is because no modern agricultural implements can be introduced with the present condition of roads. Any industry is sure to fail without an outlet to the market for its articles of commerce. Farming is no exception. The absence of good roads also does a great deal to keep this industry in a stationary condition. Owing to the long, dangerous, difficult, and expensive transportation, only a small percentage of the agricultural products of the country reach the market, and thus the price of food stuffs is raised. A farmer who is unable to send his crops to the market can not make any profit. Consequently he contentedly devotes his time to tilling his own small piece of land making no improvements or progress. The opening of good roads will lead to the introduction of modern agricultural tools which will improve the present system of farming. Cheap and easy transportation will enable every farmer to market his products and thus encourage him to raise more crops.

Good roads will have a great influence in reclaiming the waste lands of the Philippines. About 90 per cent of the land is not yet under the plow. To convert these wild fields into profitable farms the Government grants, upon application, to any resident of the Philippines a sufficient tract of agricultural land. In spite of this wise act only those lands near the roads have been reclaimed. The absence of good roads is the main reason that the waste lands are not reclaimed. Most of these lands are far from the highways; though there are some trails, passable only by man, they are practically of no value because

PLATE II.—(*a*) SECTION OF DAGUPAN-LINGAYEN ROAD, PANGASINAN PROVINCE.

How good roads not only add to the appearance of the country but improve the sanitary, health, and social conditions of every part of the Islands which they reach may be seen above. Such facilities for transportation not only add to the health and comfort of the people but to the health, long life, and greater efficiency of their animals and vehicles.

PLATE II.—(*b*) LOADS OF RICE ON PAO-UMINGAN ROAD, PANGASINAN PROVINCE.

How good roads encourage agriculture, trade, and commerce as well as assist the Government in maintaining peace and good order. They are thus added capital which increases the opportunities for enjoyment and for higher standards of living to each individual.

during the greater part of the year they are converted into mud seas of waist depth. To put these lands under cultivation means the expenditure of a great amount of capital and labor. To send to the market crops raised adds greatly to the expense, due to the difficult means of transportation. On reaching the market it must be either sold for less than the whole expense or carried back home which means more money and labor wasted. Apparently instead of making a fortune a farmer will be bankrupt.

Another discouraging outcome of the absence of good roads is the great danger to the lives and property of the farmers. Farmers should live on their farms in order to obtain good results, failure to do so, often means the failure of their crops, waste of their money, time, and labor. Just about the time they should see the fruits of their labor, their crops may be assailed by thieves who are practically immune from the Government's officials, without receiving any aid. In case resistance is shown on the part of the farmers, their lives will answer for it. The presence of good roads will not only free these peaceful farmers from danger of any kind, but also encourage them to raise more crops by cultivating more land. The introduction of modern agricultural machines will increase the quantity of food articles raised. This means the lowering of the price of foodstuffs. With low prices the products of the farms can reach every home; a greater demand for them will follow; as a consequence every farmer will apply for more of the public lands in order to supply the needs of the people. This will result in the cultivation of all the waste lands available for agriculture.

FOR TRADE AND COMMERCE.

Commerce is carried on only on a small scale on account of the absence of good roads which are a powerful factor in encouraging profitable industries. With good roads the products of the farms, shops, and factories can be transported with ease from one point to another in less time, at less expense, and in greater quantities, thus making prices low. These articles will then be placed within the reach of everyone. Every province has its own products which are needed in every other province. The shipping of goods from place to place means not only the development of commerce but also the intermingling of people which will result in the uniformity of language.

FOR THE PROVINCES.

Good roads are a great necessity in every province. Tarlac Province ranks among the first. The progress of this province depends largely on good roads. At present agriculture is not well developed. Nearly one-third of the land is not under cultivation, due to the lack of good roads. The modern agricultural machinery in this province can not reach the land far from the roads. The introduction of good roads will

increase the number of crops raised which means wealth to the province. Good roads encourage the people to travel. This intermingling of people is a valuable result especially for this province where almost all of the dialects are represented. Good roads enable the provincial government to save a large sum of money that it needs for other purposes. The traveling expenses of the provincial officials will be greatly lessened by the presence of good roads. In this province carabao thefts occur often. By good roads the province will be rid of all these hindrances to progress.

FOR THE TOWNS.

Towns, as well as provinces, need good roads to encourage their interests. Tarlac town can not advance due to the deplorable condition of its roads. In spite of the roads that connect this town to the others, practically no shipment of products is going on between them, because during the wet season they are almost impassable. The improvement of these roads will develop the commerce of this town. It is able to export its products, as well as to import its necessities, only by means of good roads. After easy transportation comes the low price of articles which will attract other people to this town to buy their stuffs. Those who are engaged in the buying and selling of rice will increase their investment to make a greater profit. The increased demand will encourage the commercial men in the town who compose one-half of the entire population to enlarge their business. Factories will be built to supply the needs of the market. Farmers will try to raise more and larger crops. New industries will spring up.

THE OLD SPANISH ROAD LAW.

At present the Government can not set aside funds sufficient to cover the necessary expenses for the construction of roads. In order to improve the present condition of roads, which the country needs more than anything else, the Government should enact a law adapted to the existing conditions providing for a road tax. During the Spanish reign a compulsory labor law was enacted, which in spite of the many abuses that came with it, rendered valuable results. At first forty days or a payment in lieu thereof was required from able male citizens every year; as the roads were improved it was reduced to fifteen days or its equivalent in money. Many of the roads now in existence were constructed under that law.

ROAD LAWS IN THE UNITED STATES.

In some States in the United States a compulsory labor law is enforced. In those places its purpose is well attained, without any bad effect coming with it, due to the strict and impartial ruling. Since this law is such an unqualified success in those places where the Government is practically the same as ours, why should it not be adopted here as well? Because it was misused under the former régime is no reason to

believe that it will be abused now. The workman of yesterday is not the workman of to-day. It is true that many of the Filipinos would object to such a law, but anyone realizing its value will not only approve it but insist upon its passage. Almost all of the provincial governors, who, on account of their great knowledge of the present condition of the Islands, know the best measures to be taken, not only favor the labor-tax law but urge the Government to pass it. Inasmuch as many of the inhabitants are farmers they would prefer to work on the roads during their leisure time rather than to pay money. At present the only method whereby the roads can be cared for is to enact a law requiring very able-bodied male inhabitant between the ages of 18 and 60 to work at least five days on the public roads or to pay into the provincial treasury money equivalent to five days' labor. The money collected in this way must be spent wholly for road construction under the discretion of the provincial board.

ENEMIES OF GOOD ROADS.

Both nature and the people side by side help in the destruction of roads. Torrential rains which come every year wash out the roads. Carabao carts and native sledges and the overflowing of streams damage the roads a great deal. The encroachment of houses upon the roads and the stealing of bridge materials are destructive of good roads. Roads should be so constructed as to permit the water to flow toward their sides where canals should drain them. To enforce the act prohibiting the use of rigid-wheeled carts and permitting the use of broad-tired carts will help to keep the roads in good condition. It should be enforced in every town. In towns where it is strictly followed, it has worked splendidly. At first it was looked upon as a means for oppressing the people. As soon as they saw that with the new carts they were able to carry more goods in less time, they began to supply themselves voluntarily with the new carts. What happened in those towns will happen in others. A law should be enacted providing for the punishment of anyone who in any way damages the roads.

THE MAINTENANCE OF GOOD ROADS.

The repairing and maintaining of roads should be done by the Filipinos under the supervision of anyone who understands the work thoroughly. Many of the Filipinos are out of employment not because they do not like to stretch their muscles but because no work can be offered. Many are spending their time in vices, playing "monte," cockfighting, etc. Many of these men have to use their strength dishonestly to feed their families. The opening and repairing of roads will give them an opportunity to earn their daily bread honestly. This will turn their attention from vices. By working with their hands, they will prize the roads as their own personal property, which will prevent them from

ruining good roads. Most of the Filipino laborers need a guiding hand to do their work. For this reason, one who knows all about road building should superintend the work. Under such guidance Filipino laborers will do their work just as well as anybody.

Every municipality should take care of its own roads. Many towns do not take any interest in keeping their roads in good condition. By placing the work in their own hands, they will take more pains in maintaining their highways. Every town will see that its roads are just as good as those of other towns or even better. This will lead to rivalry between towns in the maintenance of good roads.

In conclusion, the obstacles in the way of progress, as the result of the present condition of the roads in the Philippines are among the hundreds. The great need of good roads to remove these obstacles is apparent to all. Since the deplorable condition of roads is what keeps the Islands from making any lively steps toward progress, why should not the government take the necessary measures for their improvement? Not until then will our country be able to take her stand among the prosperous countries of the earth.

PROTECTION BY GRADING OF PHILIPPINE CIGARS.[1]

With the passage of the Payne Bill extending to the Philippine Islands limited free entry of tobacco, it became apparent to the Insular administration that, unless some provision was made to grade the product exported, the United States might be flooded with inferior products and thus ultimately destroy the Island trade with the home country. The Payne Bill provides for the free entry of 150,000,000 Philippine cigars during every twelve months. This means that there is a market for the best grade manufactured in the Islands or at least for standard grades. To permit the cheap under-standard cigar to become the accepted standard cigar of the Philippines in the United States would mean that it would be only a short time until a general prejudice against Philippine cigars would make the recent free trade concession of little, if any, value to the industry and practically destroy our market in the United States.

With the purpose in view of protecting this trade and of guaranteeing the quality to the American importer and consumer, the Philippine Government has provided regulations requiring grading and labeling under the direction of the Internal Revenue Bureau that meet the situation.

The following was issued, August 10, by the Collector of Internal Revenue addressed to all internal-revenue officers throughout the Islands:

> Before the removal of cigars, cigarettes, and manufactured tobacco from the place of manufacture for exportation to the United States, there shall be affixed, under the supervision of the Collector of Internal Revenue, or his duly authorized representative, to each package of cigars, cigarettes, or manufactured tobacco, an official certificate in the form of an export stamp, on which shall be shown the quality of the manufactured article, to be graded in accordance with the rules approved by the secretary of finance and justice."

[1] From The Far Eastern Review, Vol. VI, No. 3, August, 1909.

PHILIPPINE ISLANDS.
OFFICIAL CIGAR EXPORT STAMP.
Manufactured, Graded and Packed Under Government Supervision.
QUALITY
STANDARD
FOR THIS BRAND
Made by cleanly operatives in a Sanitary Factory under control of the Bureau of Health, from sound Philippine Tobacco grown in the Cagayan Valley.
BUREAU OF INTERNAL REVENUE.
PHILIPPINE ISLANDS
87770--42

FACSIMILE OF INTERNAL REVENUE STAMP FOR PHILIPPINE CIGARS AND CIGARETTES. THE WORDS "SELECTED" AND "BELOW STANDARD" ARE SUBSTITUTED FOR THE WORD "STANDARD" WHERE THE STAMP IS AFFIXED TO THESE GRADES.

The following are the rules for the grading of tobacco products before removal for export to the United States:

CIGARS.

Standard.—To be made of good, sound, and clean tobacco exclusively from the Provinces of Isabela and Cagayan, well made, with suitable wrappers, and neatly and properly packed.

Below standard.—Lacking in any of the requirements for "standard."

CIGARETTES.

Selected.—To be made of Isabela and Cagayan tobacco specially selected by leaf, and each leaf stripped of stems and the cigarettes made by hand: *Provided*, That when all other requirements are fulfilled, well-made machine cigarettes will be graded as "selected."

Standard.—To be made of Isabela and Cagayan tobacco, properly cured, sound, and clean, and to which may be added tobacco of other provinces if likewise properly cured, sound, and clean.

Below standard.—Lacking in any of the requirements for "standard."

SMOKING TOBACCO.

Standard.—To be made of Isabela and Cagayan tobacco, properly cured, sound, and clean, to which may be added tobacco of other provinces if likewise properly cured, sound, and clean.

Below standard.—Lacking in any of the requirements for "standard."

The stamp affixed is 1½ inches wide by 2½ inches in length. It is identical in form as with the illustration reduced to the size indicated. The label for "selected" is printed in green ink, "standard" in blue ink, and "below standard" in red ink.

With proper care in examining labels, importers and consumers in the

United States will thus escape being imposed upon and the reputation of Manila cigars maintained.

The export to date of Philippine cigars to the United States having the benefit of the provisions of the Payne Bill is approximately 2,000,000 and all are of standard or over standard grades so far as has been learned.

One provision of the bill that has caused some misunderstanding is to the effect that all cigars shipped from the Philippines to the United States must proceed in one bottom or in bond direct. The benefits of the bill in this respect will not apply in case of transshipment. It is understood that some shipments made previous to the passage of the bill have been held up on account of the violation of this provision. The Bureau of Insular Affairs at Washington is greatly interested in giving the product of the Philippines ample protection.

In connection with the provisions of the Payne Bill, the Philippine Government has authorized the collection of internal revenue in the Islands on importations of manufactured tobacco and other articles. The following regulations covering this have been issued by the Bureau of Internal Revenue:

1. The following articles, when imported, are made subject to the payment of internal-revenue taxes by the provisions of Act No. 1189, as amended by Act No. 1940, effective on August 7, 1909:

Schedule A, paragraph 1.—(*a*) Distilled spirits and manufactured liquors produced by the fermentation of grain, 70 centavos per proof liter.

Compound or mixed liquors, any portion of which is grain spirits, will be considered as grain spirits and taxed at 70 centavos per proof liter.

(*b*) Distilled spirits and manufactured liquors produced by the fermentation of all other substances, 20 centavos per proof liter until January, 1, 1910, and thereafter 25 centavos per proof liter.

Schedule A, paragraph 2.—Beer, ale, porter, etc., 4 centavos per gauge liter.

Schedule A, paragraph 3.—(*a*) Manufactured tobacco, 48 centavos per kilo. (*b*) Snuff, 32 centavos per kilo.

Schedule A, paragraph 4.—Cigars, (*a*) when the wholesale price is 20 pesos per thousand or less, 2 pesos per thousand; (*b*) when the wholesale price is over 20 pesos, but not over 50 pesos per thousand, 4 pesos per thousand; (*c*) when the wholesale price exceeds 50 pesos per thousand, 6 pesos per thousand.

Schedule A, paragraph 5.—(*a*) Cigarettes not exceeding in weight 2 kilos per thousand, 67 centavos per thousand until January 1, 1910, and thereafter 1 peso per thousand; (*b*) cigarettes exceeding in weight 2 kilos per thousand, 2 pesos per thousand.

Schedule A, paragraph 6.—Matches, (*a*) on each gross of boxes containing not more than one hundred and twenty sticks to the box, 40 centavos (*b*) and a proportionate additional tax where the boxes contain more than one hundred and twenty sticks.

Schedule A, paragraph 7.—(*a*) Still wines containing 14 per cent of alcohol or less, 8 centavos per gauge liter. (*b*) Still wines containing more than 14 per cent of alcohol, 15 centavos per gauge liter. (*c*) Sparkling wines, 1 peso per gauge liter.

NOTE.—Attention is invited to the fact that A–7 is a new paragraph to cover still and sparkling wines.

2. The collection of the above taxes will be made by the affixture of internal-revenue stamps to an internal-revenue Schedule A, paragraphs 1, 2, 3, 4, 5, 6, or 7, miscellaneous invoice, upon presentation of which to the customs authorities the consignment will be released, after verification and payment of any customs duties that may be due thereon.

Invoices as required above will be issued in the city of Manila by the Collector of Internal Revenue, and in the provinces having open ports by the provincial treasurer, upon presentation of a statement from the Collector of Customs showing the class of goods imported, the quantity in kilos or gauge liters, and if distilled spirits or still wines, the percentage of alcohol contained therein, the number of the import entry, the name of the vessel by which received and the date.

All requisitions for the purchase of stamps in payment of internal-revenue taxes on imported articles, and all invoices to which such stamps are affixed, shall have written or stamped in red ink across the heading the word "Imported." The same notation will also be made opposite entries on provincial treasurer's miscellaneous transcript sheet rendered to this Office.

3. Taxable articles now held in Manila customs bonded warehouses which are exempt from customs duties, may be transferred to the internal-revenue bonded warehouse upon application of the importer, and the tax collected on same upon removal therefrom in the manner provided in paragraph 2 above. For the present no internal-revenue bonded warehouse will be established outside of Manila; therefore, internal-revenue taxes on shipments imported through provincial ports must be paid when goods are cleared from the custom-house.

In case of shipments arriving at the port of Manila from the United States subsequent to August 7, 1909, the importer may, if he so desires, enter any part or all of the consignment direct into the internal-revenue bonded warehouse and remove same therefrom at any time subsequent thereto, by the payment of the internal-revenue taxes and any warehouse fees that may be due on same.

Shipments arriving from countries other than the United States may be cleared in any one of the three following manners:

(1) By the payment of the customs duties and internal-revenue taxes, after which delivery will be made direct from the custom-house by the customs authorities, upon presentation of the stamped invoice as required in paragraph 2 above.

(2) If an imported does not desire at the time of entry to pay the customs duties or the internal-revenue taxes, he may, under regulations of the Insular Collector of Customs, enter same in customs bonded warehouse and pay the duties and internal-revenue taxes on same upon removal therefrom.

(3) An importer desirous of paying the customs duties on a consignment and deferring the payment of the internal-revenue taxes may pay the customs duties, whereupon the consigment will be transferred by the customs authorities, from which it may be removed upon payment of the internal-revenue taxes as provided above.

(4) Upon removal of taxable articles from the custom-house or internal-revenue bonded warehouse for delivery to the importer, each package shall be marked with the schedule, paragraph, assessment, and invoice numbers of the invoice upon which the tax was paid, and shall likewise bear its serial number.

Upon being released from customs or internal-revenue custody, taxable articles shall be taken up in the wholesale dealer's official register book, B 6–8 or B 9, and the schedule, paragraph, assessment, and invoice numbers of the invoice upon which the tax was paid together with the serial numbers of the packages, noted therein.

THE NATIONAL AGRICULTURAL APPROPRIATION ACT 1909–10.[1]

By E. W. Allen, Ph. D.,
Editor Experiment Station Record.

An innovation as to the lump-fund appropriations hitherto made to the various Bureaus for their general expenses was adopted, under which in most cases these appropriations have been further subdivided by specifying the amount to be expended for each of the principal lines of work. Thus, the Bureau of Entomology, which last year received a lump fund of $158,800 for entomological investigations without further restrictions as to its division among the various projects under way, is by the new law granted in its stead $46,600 for investigations of insects affecting deciduous fruits, $21,000 for insects affecting cereal and forage plants, $42,000 for insects affecting southern field crops, $12,000 for forest insects, $16,250 for insects affecting truck crops and stored products, $10,000 for bee culture $16,500 for insects affecting citrus fruits, and $34,050 for other investigations. With a view to providing for exigencies due to unforeseen conditions, however, a provision was also added to the bill under which 10 per cent of the appropriation for the miscellaneous expenses of the work of any Bureau is made available interchangeably for expenditure on the objects included within the general expenses of that Bureau, "but no more than ten per centum, shall be added to any one item of appropriation except in cases of extraordinary emergency, and then only upon the written order of the Secretary of Agriculture."

The total appropriation carried by the new law is $12,995,036. This is an increase of $1,322,930 over the previous Act, or approximately 10 per cent. It makes provision for the continuance of nearly all the lines of work now under way, and in many cases their extension to meet the growing demands upon the Department.

The Weather Bureau receives a total appropriation of $1,508,260. This is a reduction of $154,000, which is due principally to the completion of the new buildings for the Mount Weather Observatory and the elimination of all appropriations for other buildings and equipment of new stations. The lines of work are essentially unchanged. The amount assigned to the investigations in climatology and meteorology is $125,000. The salary of the chief of the Bureau was increased from $5,000 to $6,000. An increase of $4,000 was allowed for contingent expenses, and the limit

[1] From Experiment Station Record, Vol. XX, No. 9, April, 1909.

of cost of maintenance of the Bureau printing office was increased from $30,000 to $45,000.

The appropriation of the Bureau of Animal Industry was increased $97,000, making a total of $1,427,860. Among the items authorized are $250,000 for the eradication of the cattle tick in the South; $625,000 for inspection and quarantine work (other than the Federal meat inspection, which is now provided for in the permanent law); $149,000 for the work of the Dairy Division; and $43,000 for the work in animal husbandry. For investigations of animal diseases and the maintenance of the Bureau experiment station, $109,000 was provided together with $25,000 for the purchase of additional land. The appropriation of $50,000 made last year for experiments in animal feeding and breeding in coöperation with the State experiment stations was continued, but the language was so altered as to permit independent investigations by the Bureau as well.

The Bureau of Plant Industry received one of the largest increases in the bill, $367,590, making its total $1,709,266. Of this $1,180,796 is for general expenses, which are further itemized to provide for thirty-two lines of inquiry. Among these may be mentioned $225,000 for demonstration work against the boll weevil, $133,000 for farm management investigations, and $71,360 for investigations of the methods of growing, packing, and marketing fruits and melons. An allotment of $76,680 was granted for coöperative demonstrations as to the utilization of arid and semiarid regions, and authority was granted to conduct coöperative work in conjunction with the Reclamation Service on its reclaimed lands. Authority to carry on breeding and testing work with fibrous plants suitable for paper making was also conferred, $10,000 being provided for the purpose. This was in addition to the paper-making tests of plants such as were authorized last year, these being continued in the new Act as a special appropriation unassigned to any Bureau and extended to include similar tests with woods.

The Bureau was given $12,250 for an investigation of the handling, grading, and baling of cotton and the establishment of standards for the different grades in accordance with previous legislation, and $52,440 was granted for similar work with grain. A clause providing for furnishing at cost to interested parties sets of cotton standards was reported by the Senate committee, but eliminated on a point of order, as was also a clause directing the Department, upon the request of grain growers, to grade their grain before shipment.

For the Congressional seed distribution, which was continued on the usual basis, an increase of $60,320 was granted, making a total of $262,320 for the purpose. The appropriation for the introduction of rare and valuable seeds from foreign countries was slightly decreased, and authority was given to expend not to exceed $10,000 of the amount in the testing and distribution of forage crops.

In the case of the Forest Service the Act carries an apparent reduction of $84,100 for statutory salaries, but this is due to extensive transfers to the lump-fund appropriation as a result of the recent establishment by the Service of six administrative districts or branch offices in the West, to which a considerable proportion of its Washington staff has been transferred. The net increase in the statutory and lump-fund appropriations was $750,000, partly on account of this change, but principally to meet the increased use to which the national forests are being put and the extension of their limits during the past year by some 17,000,000 acres. Authority to advise owners of woodlands as to their care, omitted last year, was restored, but permission was refused to arrange exchanges of private lands lying within forest reserves for stumpage of substantially equal value from the national forests with a view to their unification. For permanent improvements the appropriation of last year, $600,000, was continued, making the total for the Forest Service $4,446,200, by far the largest carried in the bill.

The Bureau of Biological Survey was granted an increase of $25,420, of which $7,000 is for the maintenance of the Montana Bison Range and other reservations for mammals and birds. Authority was given for the expenditure of the balance remaining from the appropriation of the previous year for the purchase of land for the Montana Bison Range in completing its fencing, constructing sheds and other buildings, and extending its present area of 12,800 acres to 20,000 acres.

The total appropriation for the Office of Experiment Stations, including $720,000 for the experiment stations under the Hatch Act is $1,069,220, an increase of $34,600. The allotment for statutory salaries was increased $4,640, this including an increase in the salary of the Director from $3,500 to $4,000, and the lump fund for general expenses was increased $4,800, making $34,800 available for this purpose. The appropriation for the stations in Alaska, Hawaii, and Porto Rico were each increased $2,000 to correspond with the increase to the State stations under the Adams Act, and the allotment to the Guam Station was increased to $15,000, of which $1,500 was made available for the purchase of land. For the promotion of agricultural education through farmers' institutes and agricultural schools the appropriation of the previous year, $10,000 was continued. The lines of work assigned to the irrigation and drainage investigations remained unaltered, but in consequence of their recent separation as to organization the appropriation was divided, $75,000 being allotted to the irrigation investigations, and $81,160, a net increase of $6,160, to the drainage investigations.

Authority was granted to resume the nutrition investigations of the Office, which were suspended during the transfer to Washington and reconstruction of the respiration calorimeter and accessory apparatus, an appropriation of $10,000 being made to "investigate the nutritive value of agricultural products used for human food, with special suggestions of

plans and methods for the more effective utilization of such products for this purpose, with the coöperation of other Bureaus of the Department, and to disseminate useful information on this subject."

The work of the remaining Bureaus of the Department was provided for substantially as at present. The appropriation for the Bureau of Chemistry was enlarged $53,840 in consequence of the increased business in connection with the enforcement of the Federal Food and Drugs Act. The Bureau of Entomology received a net increase of $92,720, of which $50,000 is for the extension of the gypsy and brown-tail moth campaign, making a total of $300,000 for that purpose. There was extended discussion of the soil surveys of the Department, and these were continued on the present basis. The net appropriation for both the Bureau of Soils and the Bureau of Statistics showed a slight decrease on account of transfer of a portion of their clerical work, the former receiving $232,860 and the latter $220,920. The work of the Office of Public Roads was continued on the present basis, with an increase of $29,070 to meet growing demands. The salary of the Director was increased from $2,750 to $3,000.

To provide for the increase in the general business of the Department as a result of that of the several Bureaus, additional appropriations were granted of $41,670 for the Office of the Secretary, $14,800 for the Division of Accounts, $26,740 for the Division of Publications (of which $5,000 is for labor-saving machinery for addressing and mailing publications), and $2,240 for the Library. Owing to the completion of the new structure for stable, shop, and storage purposes, for which $25,000 was appropriated in the current Act, there is an apparent decrease of $6,200 in the allotment for contingent expenses.

To the sums carried in this appropriation Act should be added the appropriation of $460,000 for the Department printing and binding, which is carried in the appropriation Act for sundry civil expenses. There are also permanent appropriations of $3,000,000 for the Federal meat inspection, and $624,000 for the Adams fund, both of which are administered by the Department, making a grand total of $17,079,036. This is an imposing aggregate, indicating a substantial and gratifying recognition by Congress of the work of the Department and of the great industry it seeks to promote.

The appropriation Act contains, as in previous years, a number of clauses specifically providing for coöperation between the Department and the agricultural colleges and experiment stations in a number of different lines of work, as for example, in animal feeding and breeding, and in general in the work of the Bureau of Plant Industry, but specifically in tests of rare and valuable introduced seeds and plants. In this way Congress indicates its recognition of the fact that the interests and purposes of these institutions are to a large extent identical and that they shall as far as practicable be mutually helpful.

IRRIGATION WORKS IN FORMOSA.

By H. Nagao,

Chief of the Public Works Department of the Government of Formosa.

BRIEF EXPLANATION OF IRRIGATION WORKS.

The relative condition of soils and climate on the Island of Formosa is well adapted to the cultivation of rice and sugar cane. At present there are about 310,000 *ko* (1 *ko*=2.42 acres) in paddy fields, and about 320,000 *ko* in other vegetable gardens, about 300,000 *ko* of which area is planted to sugar cane. From these areas about 4,000,000 *koku* (1 *koku*=5 bushels) of rice and 100,000,000 *kin* (1 *kin*=1⅓ pounds) of sugar are produced annually. The small crop production is due to the imperfect system of irrigation works.

Of the total area in paddy fields, about two-thirds, namely 200,000 *ko,* are irrigated by the existing 10,000 canals and reservoirs (which are not sufficient throughout the two crop seasons), and the remaining, about 110,000 *ko,* depend entirely upon the rainfall. Under such circumstances the crop is a sort of speculation, as in a dry season it will be almost nil, while if there is enough rain, a large crop can be raised.

With a proper system of irrigation it is estimated that the paddy fields could produce about 25 *koku* (125 bushels) per *ko,* and improved sugar cane could be planted in the place of native cane; in addition to that on paddy fields where two crops are not raised, uplands and plains might be converted into vegetable gardens or sugar gardens. With the increase of arable land the productive power of the land will be increased so as to yield 6,000,000 to 7,000,000 *koku* of rice, and 200,000,000 to 300,000,000 *kin* of sugar a year.

The irrigation works now contemplated are the works of the first period, which intends to carry out only a portion of the plans. When the island is divided into three sections of north, middle, and south, the northern section has the best facility for irrigation. Thirty-one per cent of the paddy fields are in the north, 32 per cent in the central, and 37 per cent in the south. But returns for production show that the northern section produced 31 per cent, the central 38 per cent, and the southern 25 per cent of the crop.

This is a result under natural conditions, as no effort was made in the way of improving the physical condition of the island. The numerous streams and abundant rainfall in the island foretell the possibilities for the success of artificial works. Taking into consideration the uplands, plains, and barren lands to be converted into arable lands, and the paddy fields and gardens, which at present yield only one crop but will be made to produce two crops, the future of irrigation works is very promising.

DISTRIBUTION OF RAINFALL.

The northern section has the most abundant rainfall, then the central and southern sections follow in order.

The number of rainy days and the average annual rainfall based on averages taken up to 1894, show that the rainfall in Keelung at the north end of the island is 3,573 millimeters and the number of rainy days 219; in Taichu in the center of the island the rainfall is 1,943 millimeters and the number of rainy days 126; in Tainan at the south end of the island rainfall is 1,663 millimeters and the number of rainy days 109. From these data the distribution of rainfall in Formosa may be understood.

PHYSICAL CONDITION OF STREAMS.

In Formosa the mountain ranges which form the backbone of the island run lengthwise from north to south. A great portion of the western half and a portion of the eastern half consist of plains. Hence, in most cases, the length of streams which run from east to west is short; even the longest one does not exceed 100 miles. There are many mountains which tower 10,000 feet above sea level. Under such a formation the streams are naturally rapid. It is no wonder that with such poor engineering facilities the Formosan natives were not able to overcome the natural difficulties and to utilize the power in their streams for the industrial improvement of the island.

SUMMARY OF WORKS.

The works now contemplated involve the construction of fourteen canals and reservoirs, of which twelve are canals which draw water from rivers and streams, and two are reservoirs. As a result of these works water power can be utilized in five different places. When water is taken from rivers water sluices will be constructed at the heading according to the size of each river, and both the front and back will be protected with walls; where a temporary dam of masonry or concrete will be constructed.

The appropriation for these works is 26,627,060 *yen*[1] 22,544,000 *yen* for canals and reservoirs, 3,760,000 *yen* for water power, 123,050

[1] A Japanese coin which is about 49.8 cents, United States gold.

yen for investigations, and 200,000 *yen* for buildings, which together with the expenses for salaries and offices, make 30,000,000 *yen* in all.

The following is a list of canals, showing the names, headings, and length of the canals:

1. Shishito (water to be taken from the Rono River; length of main canal, 42½ miles).

2. Taiko-Korisho (water to be taken from the Daian River; length of main canal, 14½ miles).

3. Ankei (water to be taken from the Kobi River; length of main canal, 14½ miles).

4. Ratow-Parisha (water to be taken from the Gaisen River; length of main canal, 22½ miles).

5. Neighborhood of Toi (water to be taken from the Gilan River; length of main canal, 12½ miles).

6. Hatsupo-Koroton (water to be taken from the Taiko River; length of main canal, 30 miles).

7. Jugosho-Happo (water to be taken from the Dakusui River; length of main canal, 37½ miles).

8. Dakusuisho (water to be taken from the Dakusui River; length of main canal, 7½ miles).

9. Rokujoka (water to be taken from the Shin Kobi River; length of main canal, 25 miles).

10. Neighborhood of Toroku (water to be taken from the Seisui River; length of main canal, 15 miles).

11. Seisuikei (water to be taken from the Seisui River; length of main canal, 12½ miles).

12. Soko (water to be taken from the Keisui River; length of main canal, 55 miles).

In addition to the above twelve canals, a dam 90 feet deep and 1,800 feet long will be constructed in the upper stream of the Taikokan River, where it will be possible to store 7,000,000,000 cubic feet of water, and near the mouth of the lower stream another dam will be constructed 30 feet in depth. A canal 45 miles long will lead from this latter dam.

A dam 90 feet deep and 1,140 feet long will be constructed in the upper course of the Nisoko River, where 3,270,000,000 cubic feet of water may be stored and a canal 50 miles in length will connect with it.

It is estimated that the dam in the upper course of the Taikokan River will provide for the irrigation of 20,000 *ko* of high land in the country of Chureki, while that in the upper course of the Nisoko River will provide for the irrigation of about 20,000 *ko* of arid country in the region between Tainan and Kyoshito in south Formosa.

The main canals will aggregate 390 miles in length. In addition to these there will be 1,560 miles of branch canals. In connection with

the irrigation works there will be installed electric power generating plants as follows:

	Horsepower.
Shishito	2,000
Neighborhood of Korisho	1,200
Nisokokei	4,000
Koroton	2,500
Seisuikei	1,050
Total	10,750

Table showing the extent of the proposed works.

Name of prefecture in which located.	Name of the works.	Expenditures for works.			Result of work.	
		For canals and reservoirs (yen).	For power plants (yen).	Total (yen).	Area to be irrigated (ko).	Electric power (horsepower).
Banshoryo	Shishito	599,000	912,000	1,511,000	4,000	2,000
Bioritsu	Korisho near Taiko	855,000	496,000	1,351,000	3,000	1,200
Toroku	Ankei	570,000		570,000	4,000	
Hozan and Tainan	Nisokokei	6,175,000	1,113,000	7,288,000	20,000	4,000
Gilan	Ratow, Parisha	285,000		285,000	4,940	
Do	Neighborhood of Toi.	275,500		275,500	5,000	
Taichu	Up and Down Happo, Koroton.	475,000	591,000	1,066,000	11,000	2,500
Shoka	Jugosho, Hatsupo	475,000		475,000	21,000	
Nanto, Shoka, and Toroku.	Dakusuisho	237,500		237,500	900	
Toen and Taihoku	Near Chureki, Hakkaisaku.	7,600,000		7,600,000	20,000	
Toroku	Kajoka	532,000		532,000	4,500	
Do	Near Toroku	475,000		475,000	3,000	
Do	Seisuikei	570,000	648,000	1,218,000	2,000	1,050
Hozan and Ako	Soko	3,420,000		3,420,000	15,000	
Total		22,544,000	3,760,000	26,304,000	118,340	10,750

It is estimated that the financial result of these works, as stated above, will each year bring an increase to the Government revenue, and after ten years, it will be increased by 3,470,000 *yen* in the aggregate of water taxes, charges for electric powers, and land taxes.

The aggregate receipts for twenty years beginning with the first year are estimated at about 38,060,000 *yen*. Moreover, it will bring a great material benefit to the general economical conditions by increasing the productive power of the island; as paddy fields and vegetable gardens, which were imperfectly irrigated in former times, uplands and plains may be converted into perfect paddy fields.

In figuring these prospective receipts, rice was taken as the basis of the estimate but as it is believed that the receipts from the sugar-cane crop will be larger than those of the rice crop, the above figures will be very conservative.

The following will give a comparison of the receipts from rice and cane crops, which will show the very profitable returns from irrigation work. The estimation was made on the basis that with crops each year 25 *koku* (125 bushels) of rice could be produced from 1 *ko* (2.42 acres). The cane crop requires alternate cultivation with other cereals and it is

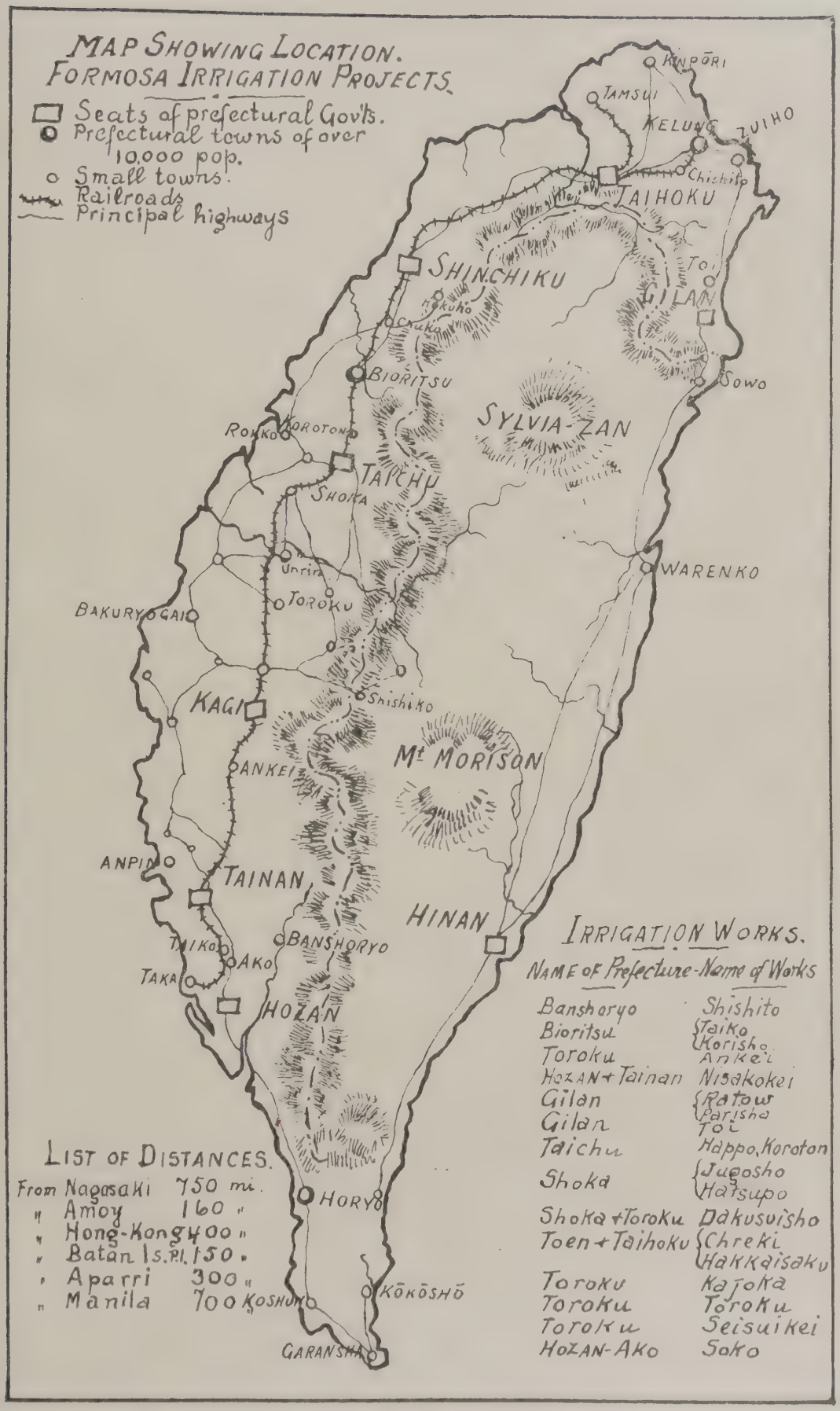

PLATE III.—MAP OF FORMOSA IRRIGATION PROJECTS.

estimated that for the first year 100,000 *kin* (133,334 pounds) of sugar cane will be produced, in the next year by sprout growing 70,000 *kin* (93,334 pounds) of cane, and in the third year, by rice cultivation, 25 *koku* (125 bushels) of rice.

EXPENSES AND RECEIPTS FOR RICE CULTIVATION.

[Per 1 Ko. (2.42 acres).]

Expenses.

Crops and items.	Expenses (yen).	Remarks.
First crop:		
Paddy seeds	1.50	Paddy shoots per *ko*.
Fertilizers	27.72	Manures and oil cakes for shoots, gardens, and paddy fields.
Labor	36.35	Wages for farm laborers for tilling, sowing, manuring, transportation, planting of shoots, weeding, harvesting, drying, preparation of rice, and hire for plowing cows.
Second crop:		
Paddy seeds	1.50	Same as for the first crop.
Fertilizers	1.72	Manures for shoots, garden, and oil cakes.
Labor	28.57	For tilling, sowing, manuring, planting of shoots, weeding, bending of rice stalks, harvesting, drying and preparation of rice; hire for plowing cows.
Total	97.36	

Receipts.

Products		Unhusked rice.
Amount	koku	50
Value	yen	175.00
Value per koku	do	3.50

Estimate of receipts and expenses for three years.

	Yen.
Receipts	525.00
Expenses	292.09
Balance net profit	232.90

EXPENSES AND RECEIPTS FOR SUGAR CANE CULTIVATION.

Expenses.

Year and items.	Amount of expenses (yen).	Remarks.
First year:		
Shoots	7.50	15,000 shoots 0.50 yen per 1,000.
Fertilizers	70.00	Manures and fertilizers.
Labor	48.00	Wages for farm laborers for tilling, planting of shoots, manuring, middle plowing, weeding, cutting and transportation of canes, hire for plowing cows.
Second year:		
Fertilizers	70.00	Same as for the first year.
Labor	36.00	For manuring, middle plowing, weeding, cutting, and transportation of cane, etc.
Expenses for sugar manufacture	255.00	First year, 100,000 *kin* of cane; second year, 70,000 *kin*, making in all 170,000 *kin*; expenses for manufacture 1.50 yen per 1,000 *kin*.
Miscellaneous expenses	41.40	Packing expenses, 22 sen per bag: godown rent, 0.01 sen per bag.
Total expenses for sugar crop	527.90	Total number of bags, 189.
Third year:		
Expenses for rice cultivation	103.96	In this year alternate cultivation is required, more laborers are required for tilling the ground, and 6.60 yen is added besides the ordinary expenses.
Total expenses	631.86	

Receipts.

Products.	Values. (yen).	Remarks.
Raw sugar	1,170.00	First year, 11 per cent from 100,000 *kin* of canes; second year, 10 per cent from 70,000 *kin* of canes, making in all 18,000 *kin*; price per 100 *kin*, 6.50 yen.
Molasses	32.40	15 per cent from 18,000 *kin* of raw sugar; price per 100 kin, 1.20 yen.
Rice	175.00	
Total receipts	1,377.40	

Estimation of receipts and expenses for three years.

	Yen.
Receipts	1,377,400
Expenses	631,865
Balance, net profit	745,535

NOTE.—There is no difference in the Government taxes on rice and cane crops, so that they are not enumerated under the expenses.

As stated in the above, the cane crops when compared with those of rice, shows larger receipts, 512.63 *yen* in three years, or 170.88 *yen* per *ko* a year.

Although it is permissible to estimate on the basis that the total area of paddy fields, 118,350 *ko,* under the present plan will be converted into cane gardens, but such an estimate would be considered as too far from the facts. Accordingly, by deducting the paddy fields, which are required to yield rice for the annual consumption of 4,000,000 natives (estimated population after ten years based on the Government statistics for 1905), the average annual consumption of rice per head is estimated at 1 *koku* 2 to 3 *sho* (about $6\frac{1}{4}$ bushels) from the total area, the remaining 45,000 *ko* may be converted into cane gardens.

By multiplying the annual profit per *ko,* namely, 170.88 *yen,* by the remaining area, increased receipts of 7,689,600 *yen* will be obtained, beside the annual receipts from the irrigation work now contemplated it will bring an extra revenue to the Government of 5,400,000 *yen* in the form of the sugar consumption tax.

HINTS ON COCONUT CULTIVATION.

By A. H. Benson,
Instructor in Fruit Culture for the Department of Agriculture of Queensland.

The following hints on coconut cultivation by Mr. A. H. Benson, instructor in fruit culture for the department of agriculture of Queensland, includes some important and useful suggestions:

1. *The selection of seed nuts for planting.*—As a result of personal observation and inquiry in many coconut-growing countries it is very evident that there is a general want of care shown in the selection of seed nuts for planting. Almost no attempt has been made to improve the strain of coconuts in the East.

2. *Study of soils.*—It is well known that coconut trees prefer a light sandy soil, and that they can stand the presence of a large amount of saline constituents in the soil. They grow best along the exposed coast line just above the high-water mark where they are exposed to the sea breezes which are favorable to their development.[1]

3. *Cultivation of the soil.*—It has been noted that comparatively little attention is usually paid to keeping the surface of the land devoted to coconut plantations in a good state of tilth and free from weeds.

4. *Supplies of nitrogen and potash.*—Coconut trees require a fairly large supply of nitrogen and potash. Phosphates are needed to a smaller extent but lime is essential. Nitrogen may often be supplied by growing leguminous crops underneath the tress and plowing the green vegetation under the soil. A supply of potash does not appear to be necessary until the trees come into bearing, at which time it is found to have a very distinct influence on the yield of nuts produced.

5. *Animal manure.*—Animal manure is also highly valuable although it is usually difficult to obtain in districts where coconut cultivation is carried on.

6. *Nursery.*—It is often noticed that proper attention is not given to seed nuts during the germination period and that they are kept in heaps instead of being planted in a nursery as they should be where the individual seed nuts can receive the necessary attention, particularly with reference to shade and moisture.

[1] However, with proper soil and climatic conditions they will thrive considerable distances from the sea.—Editor.

7. *Planting.*—When the young plants are about 18 inches to 2½ feet high they may be planted out where they are to grow permanently. They should be set in holes 2 or 3 feet square and about 2 feet deep, dug at distances of 30 by 20 feet apart. At the bottom of the hole should be placed a few spadefuls of a mixture of top soil and cow manure.

8. *Subsidiary crops.*—For the purpose of keeping the soil of the coconut plantation free from weeds and in a good state of tilth, such crops as pineapples, peanuts, cotton, or sweet potatoes may be planted. These crops should alternate with leguminous crops to supply the necessary nitrogen for the soil.

9. *Harvesting seed coconuts.*—Coconuts should be gathered when fully ripe and not allowed to fall to the ground, especially when they are to be used for seed purposes.

10. *Copra.*—For the manufacture of copra, the husk is first removed and the nuts split in halves to allow the removal of the meat.

11. *Drying coconut meat.*—The most up-to-date method of drying copra is by the use of a fruit evaporator. In most countries in the East the coconut meat is either dried in the sun or over a primitive kiln. Kiln drying takes only twenty-four hours while drying in the sun usually requires two or three days.

CURRENT NOTES.

AN IMMEDIATE BENEFIT OF FREE TRADE.

As a result of the Free Trade Law, the Germinal Cigar Company is making arrangements to enlarge their factory and to increase its production. This step was made necessary by the large demand for Philippine cigars in the United States. The Germinal Company shipped a half million of cigars to the United States by the *Mongolia* on her last trip from Manila, and another half million was shipped to the United States on the steamer *Lothian,* which arrived in Manila on August 24 and sailed for the United States via the Suez Canal. These two shipments included Divinos, Army and Navys, Perfectos, and Panetelas. To meet the increasing demand for the product of the Germinal factory, the company has purchased from Sr. Chiudian and Sr. Sunico about 5,600 square meters of land adjoining their factory which will cost approximately ₱150,000.

CONDITIONS IN JOLO.

It is reported that trade in Jolo has picked up wonderfully since the extermination of Jikiri and his band has become generally known. The customs receipts for Jolo during the month of July were ₱4,217.28 more than for the same month last year. This large increase in customs receipts is due to the fact that the Chinese merchants who were driven from their places of business by the depredations of the bands of outlaws are now going back and they are obliged to buy entire new stocks of goods brought in from Borneo and other foreign territory. The collector of customs believes that the increased importation will continue throughout the year and that the receipts from import duties will be larger by a considerable amount than last year.

During July there were abundant rains in Jolo and crops are in a very promising condition. A large amount of hemp is raised but as the Moros do not strip it clean, and soak it in water for two days before taking it to market, it brings but a low price.

UNEXPLORED LANDS IN LUZON.

The Bureau of Lands and the Bureau of Science are preparing to send a joint expedition to the northeastern portion of Luzon, at the close of the rainy season, for the purpose of making topographical and geological investigations. As yet there have been no scientific explorations made in that portion of Luzon lying between Cape Engaño and

Palanan, where Aguinaldo was captured. This region is a vast wilderness, at the present time inhabited by wild tribes; it is supposed to abound in a wealth of mineral ore and rich forests. So far as known the only white men that have been in this section are Mr. Fergusson and Mr. Clarke, geologists, and Mr. Martin, official photographer of the Bureau of Science. It is believed that the western portion is inhabited by Negritos, and the soil is said to contain large deposits of coal and other minerals. The eastern part comprises a strip of land about 25 miles in width and 150 miles in length.

MODERN SUGAR MACHINERY FOR PANAY AND NEGROS.

According to a recent report, the planters of Panay and Negros are beginning to realize the necessity of using modern machinery on their sugar plantations. Two complete modern sugar mills arrived in Iloilo on the last trip of the *Isla de Panay* from Europe. One of the mills is for a hacienda in Negros and the other for one in Antique Province.

SAN MIGUEL—TARLAC IRRIGATION SYSTEM.

We are advised by the irrigation division of the Bureau of Public Works that the San Miguel—Tarlac Irrigation system, which will cost approximately ₱300,000, will be one of the very first irrigation projects to be installed by the Insular Government. This project will irrigate an area covering from 4,000 to 5,000 hectares of land, the water to be drawn from the O'Donnell River. This territory is not now under cultivation, but it is expected that at least 1,000 hectares will be ready for cultivation by next season. The principal crop to be raised on these lands is rice. Towns have been planned for newcomers, and the opening up and putting under cultivation of this tract will give employment to a large number of people.

DIRECT SHIPMENT UNDER THE NEW TARIFF LAW.

According to a decision of the United States Treasury Department, all shipments from the United States to the Philippines must be made direct without transshipment in order to entitle importers of goods to the benefit of the provisions of the new tariff law. It is believed that this decision of the Treasury Department will prove one of the best steps that has been taken for the development of trade between the United States and the Philippines. The steamship companies which have enjoyed the greater part of the carrying trade between these Islands and the United States have had the benefit of this trade giving litle consideration to the people of the Philippines; for years past, the same as before American occupation, they have run their lines to Japan and along the China coast with Hongkong as a terminal leaving Manila and the Archipelago almost entirely out of the question. Only recently has there been any disposition on the part of the large steamship

companies on the Pacific to make Manila a port of call. With the construction placed upon the new tariff law by the United States Treasury Department Philippine importers and merchants will be required to ship their goods direct from United States ports to Manila and these companies will have to make Manila a port of call for their boats traveling between the United States, Japan, and China or turn this carrying trade over to others. The benefit to all interests in the Philippine Islands of direct steamship lines between San Francisco or Seattle and Manila can hardly be overestimated. Such an arrangement would mean in the first place a great saving for the Insular Government in time and money. At present approximately one-half of the time taken for transporting employees to and from the United States is consumed in traveling from Manila to Hongkong, Shanghai, and Japanese ports to Yokohama. A direct line from San Francisco or Seattle to Manila would mean a saving of approximately one-half time on the travel of all Insular employees and sooner or later a considerable reduction in the passenger rate as well as in the freight rates between Manila and the United States. At present with most of the ship companies the call at Manila is only incidental as a part of the voyage of their large steamers. With such a change as the decision of the Treasury Department would seem to predict Manila would become a regular and important port of large and growing carrying trade. It would seem that the commercial carrying trade together with the civil and military transportation work would make a paying business for any one of the large steamship lines. It is hoped that no shortsighted policy on the part of importers and shippers will interfere with this step of the Treasury Department which can accomplish more for the progress of the Philippine Islands in a single decision than our Insular Government and Merchants' Association could accomplish in years by petitions or by spending thousands for promotion work.

RANGOON RICE FOR THE PHILIPPINES.

A shipment of over 3,000 tons, 50,000 *cavans,* of rice from Rangoon, was recently consigned to Manila dealers. This is the first large cargo of rice from Rangoon for several years and, it is believed, foretells a heavy shortage in the Philippine rice crop, caused by the prolonged drought during the last of June, July and August.

The crop is at present more than one month behind, owing to the plowing having been delayed by the dry weather. This means at least one month's importation of foreign rice, equal to 600,000 to 700,000 piculs, which will cost from three to three and one-half million pesos before the new crop can be used. The Philippine Weather Bureau reports the present drought to have been the worst for the month of August during a period of more than fifty years past.

PHILIPPINE CIGARS FOR NEW YORK.

On September 4th the steamer *Lothian* sailed from Manila for New York, via Singapore, with 40 cases containing 200,000 Londres and 50,000 Perfectos, the balance of the cargo consisted of 22,475 bales of hemp, 20 cases of native hats, and 247 packages of general cargo.

CONSERVATION AND AGRICULTURE.

The Editor of "Agricultural News" calls attention to the Experiment Station Record, published by the Secretary of Agriculture for the United States, in which attention is called to the phases through which agricultural production usually passes. These phases are designated as follows:

1. The period of spoliation of virgin land by the soil robber, a proceeding that can be justified only by the poverty of the settler or his lack of capital.

2. The period of diminished production per acre for which the farmer is unable to account, which is nevertheless an inevitable consequence of the spoliation of virgin land.

3. The period when scientific information as to the best means of improving the productivity of the land is put into practice.

A policy of conservation on the part of the Government of these Islands would save the future of Philippine agriculture from the soil robber and the consequent diminished production of agricultural lands in future years.

TAYABAS OIL FIELDS.

According to Dr. George I. Adams, geologist of the division of mines, who has collected samples of the oil from the Tayabas fields, the prospects for prospective investors for the development of these fields are very encouraging.

The crude petroleum from the Tayabas Peninsula has a very light specific gravity and only two or three fields in the world produce an oil comparable with it. It is very desirable for distillation since it contains an unusually high percentage of gasoline and kerosene and would accordingly command a high price in the market. Oil seeps were visited on the Ajus River, which reaches the coast between Catanauan and Mulanay, and in the valley of the Vigo River. In the latter place it is accompanied by some gas which rises to the surface when a pole is thrust into the bed of the stream.

On the Bahay River there is a place where the oil may be seen rising on the surface of the water and flowing on the stream. The valley of the Bahay River is likewise staked as oil claims. Dr. Adams has made special reports on the oil fields of Texas, Indian Territory, and Kansas for the United States Geological Survey, and his opinion regarding

the oil showings in Tayabas Peninsula is that they are fully as encouraging as those which have led to the bringing in of successful wells and the exploiting of large fields in the United States.

A MARKET FOR PHILIPPINE ANNATTO.

[Chr. Hansen's Laboratory.—Manufacturers of dairy preparations, junket tablets, colors, and flavors.]

LITTLE FALLS, N. Y., U. S. A.,
July 12, 1909.

DEAR SIR: We beg to acknowledge receipt of your esteemed favor of May 20 as well as sample of annatto seed (Achiote). Messrs. D. H. Burrell & Co. of this city have also sent us the sample you sent to them. These samples show a good quality of seed but poor curing. The product is too dry and has lost at least 30 per cent of its coloring power in the process of drying. The seed should be picked from the bush while still quite moist and cured under shade, not in the sun. We are sending you samples of Jamaica and Porto Rico annatto seed. They are not as bright and fresh as when first harvested, but you will notice that they are still considerably brighter and more "oily" than your samples. There is no doubt that the Philippine Islands can produce excellent annatto when the farmers learn how to cure the seed. The price in this market ranges from 4 cents to 8 cents per pound f. o. b. New York. We expect to pay about 6 cents per pound next season when the crop comes forward from January to March, but the market price depends, of course, on the demand and supply, and we never know until it comes forward how the crop is.

Very truly, yours,

CHR. HANSEN'S LABORATORY.

ILOILO SUGAR SHIPMENTS.

On July 29 the steamers *Foochow* and *Sorsogon* sailed from Iloilo with sugar cargoes amounting to 27,339 piculs and the coasting steamer *Mauban* was loading a sugar cargo with which she expected to sail two days later from the same port. The price of sugar advanced in Iloilo from 5 pesos 1½ reals on the 1st of July to 5 pesos 4 reals on the last of the month.

A sugar cargo of 3,100 piculs left Iloilo for Tientsin on the British freighter *Kaifong,* August 14; between August 17 and 23 the *Sungkiang* took 1,876 piculs to Hongkong and the *Chinkiang* 15,337 piculs to Shanghai and 5,000 piculs to Chinkiang. Later the British steamer *Lismore* loaded a cargo of sugar for Baltimore in the United States. At present the shipments of sugar from Iloilo from this year's crop are considerably more than those of last year, the amount of the superior grade which has so far left the southern port is 1,231,505 piculs, as against 1,053,569 piculs for the same period of last year.

HEMP STATISTICS.

Exports of hemp, July, 1909.

July, 1909.	Vessel.	London.	Liverpool.	Atlantic.	Pacific East and California.	Continent.	Australia.	Other ports.	Total.
1	Loongsang	139,686	69,581	261,178	50,971	35,131	8,803	18,462	583,812
1	Loongsang	50							50
1	Socotra	50	7,421			49			7,520
3	Rubi	2,064				1,050		450	3,564
6	Taming	4,170							4,170
10	Gymeric			21,275					21,275
10	Titan				1,850				1,850
10	Yuensang	350				552		474	1,376
11	Kumeric				8,190			2	8,192
11	Zafiro							2	2
12	Niko Maru						990		990
12	C. Lopez y Lopez		2,150			219			2,369
12	Tean					100			100
15	Seminole				3,753				3,753
16	Rubi					100			100
17	Seneca			4,250					4,250
18	Taming	1,000							1,000
20	Prinz Segismund						832		832
21	Taming, Cebu	2,065	1,698						4,663
22	Taiyuan						40		40
23	Yuensang		1,910			222		265	2,397
23	Foochow, Cebu	800							800
25	Minnesota				10,495				10,495
25	Zafiro	1,000						550	1,550
30	Tean	750				375		100	1,225
30	Niko Maru							210	210
31	Loongsang					260		150	410
31	Indravelli, Cebu			20,230					20,230
	Total	152,885	82,760	306,933	75,259	38,058	10,665	21,024	687,584

NOTES FROM OTHER FIELDS.

FORMOSA SUGAR INDUSTRY.

According to Mr. K. Oshima, chief of the civil administration for Formosa, the protective policy adopted by the late General Kodama has done very much to develop the sugar business in Formosa. The cultivation of sugar cane, which was at first confined to Tainan and its vicinity, has now been extended to Taichu and Taihoku rice fields, which formerly produced only one crop a year. It is estimated that a crop of 250,000,000 *kin* (a *kin* is about $1\frac{1}{3}$ pounds) will be obtained during the next fiscal year and it is anticipated that before long these lands will produce a crop of 500,000,000 *kin*. In Java and Hawaii 160,000 *kin* is the yield per *ko* (1 *ko*=2.42 acres), while in Formosa only 60,000 *kin* are raised in the same area. With the installation of the irrigation projects which have already been planned, for which funds have been provided, it is believed that Formosa will be able to obtain as much of a yield per *are* as Java or Hawaii. New sugar refineries are being established, and a fourth sugar mill, recently purchased from the Honolulu Iron Works, has been installed. The governor-general states that he intends to encourage the development of the sugar business in the island by extending the protection to the manufacturers in such a way as not to affect the sugar refiners of Japan.

JAPANESE WOODS FOR THE UNITED STATES.

According to a recent report, the Atchison, Topeka and Santa Fe Railroad is making arrangements for a series of experiments with woods from Japan. A large shipment, consisting of 170,000 sleepers of cocabola and Japanese oak has been received, and the sleepers are now being prepared for use. These woods cost delivered in California about $1.15 or a little more than the price paid for American oak, which is so scarce that it is considered necessary to seek outside sources of supply. The price paid by the railroad companies in the Philippines for such materials is approximately one-half that paid for the Japanese woods delivered in California. According to the Director of Forestry there are several kinds of Philippine woods satisfactory for use in railway construction, in fact 11 different kinds of Philippine woods are used by the Manila Electric Railroad Co. The Director of Forestry believes that these woods could be delivered in California as cheaply as the material which the Santa Fe Railroad is now buying from Japan.

KAUAI ONION CROP.

According to the Pacific Commercial Advertiser, Mr. George H. Fairchild of Kealia, Kauai, reports remarkable success in growing onions. In his experience with one variety, he states that it produces fine onions at the rate of 15 tons per acre. The price to be realized is growing to be profitable, apparently as large as those of most other agricultural enterprises, while it has the additional merit of bringing returns in a far shorter time than pineapples, rubber, sisal, and most of the other established industries. Beside this, the necessary outlay is exceedingly small and the quick returns are out of proportion to the sum invested. It is estimated that Honolulu uses 50 tons of onions a month, say 600 tons a year, so that 40 to 60 acres of onions should pay farmers near Honolulu a very handsome profit. The seed used by Mr. Fairchild was obtained from Portugal, and he recommends it in preference to the seed that is furnished by the best seed houses in the United States. The better results obtained from the Portuguese seed is attributed to the fact that the climate in Portugal is very much the same as in Hawaii. A large amount of onions is imported, from month to month, into the Philippines and it is believed that the climate in some parts of these Islands should be as favorable for this industry as is that found in the Hawaiian Islands.

FARMERS INSTITUTE WORKERS.

The annual meeting of the American Association of Farmers' Institute Workers, was held in Portland, Oregon, on August 17. Among the most interesting subjects of discussion were the practicability of conducting demonstrations in stock feeding and management, and the advisability of employing experts to devote their whole time to visiting farmers and offering advice respecting the improvement of their practice. Another plan which aroused considerable interest was that for establishing a movable school of agriculture to be maintained in the field during the entire year. The report of the proceedings of the sessions of this convention is awaited with great interest.

PINEAPPLE OUTLOOK IN HAWAII.

Many factors are at work which make the future of the Hawaiian pineapple and canning industry one of great promise. The advertising campaign which is being carried on for Hawaiian pines has been so effective and the resulting demand has been so great that the reserve stock has been disposed of and delivered. Another great stimulus to the industry has been afforded by the Alaska-Yukon Pacific Exposition, where the sales of these fruits have already justified the expense of the pineapple growers at the exposition. It is believed that the reputation of the Hawaiian pines will be carried by the Seattle visitors into every part of the country, and that inquiry will be made for Hawaiian canned fruits from entirely new localities so that the resources of

Hawaiian plantations and canneries will be taxed to cope with the demand.

RUBBER IN HAWAII.

The Director of the Hawaiian agricultural experiment station, Mr. E. V. Wilcox, has received reports upon samples of rubber which were sent to Hamburg, Germany, and New York. These reports place a valuation upon the better grades, which were the product of experimental tappings at Nahiku, that equals the price paid for the best plantation Para from Ceylon. Messrs. Seigmud, Robinow & Son, the Hamburg firm, make the following quotations in United States currency.

No. 1, fine pale, yellow biscuits, $1.24½.

No. 2, same biscuits, lighter in color and less spotted, $1.31.

No. 3, mixed scrap and rubber in small pieces, $1.00½.

Qualities numbered 1 and 2 are preferred. These grades of rubber found ready sale on the Hamburg market.

SUGAR GROWING IN HAWAII.

The dual mill of the Hawaiian Commercial and Sugar Company on Maui closed down in July after a record run of grinding. During this time 52,725 tons of sugar were produced from a little more than 376,000 tons of cane. A brief consideration of these figures, which are only for one plantation, gives one an idea of the magnitude which the Hawaiian sugar crop is assuming.

The total sugar area is estimated at 105,000 acres. About 50 per cent of this acreage was practically arid land which has been reclaimed entirely by private enterprise, by means of irrigation. The cost of reclamation with the provision of necessary irrigation has been about $140 per acre.

AGRICULTURE IN THE FEDERATED MALAY STATES.

The Director of the Bureau of Agriculture for the Federated Malay States in his report for 1908, puts the agricultural acreage at 319,722 acres which he divides among the several states as follows:

	Acres.
Perak	131,830
Selangor	111,710
Negri Sembilan	58,718
Pahang	17,464
Total	319,722

This acreage which excludes paddy lands and horticulture, is planted with staple products as follows:

	Acres.
Coconuts	118,697
Rubber	168,048
Coffee	8,431
Other forms of cultivation chiefly tapioca	24,546
Total	319,722

Cultivation of coffee at the present price leaves a profit. In the Klang district of Selangor, coffee is planted but it is not expected that it will become a prominent rival to rubber cultivation.

The acreage under coconuts increased during 1908 by 3,310 acres in Perak, 1,848 in Selangor, 779 acres in Negri Sembilang, and 200 in Pahang. Of the area under coconuts it is estimated by the inspector of coconuts, Mr. L. Brown, that the area under cultivation increased 6,137 acres during 1908, 1,600 acres of this being on estates owned and managed by Europeans. The amount of copra exported during the year was 49,016 piculs for Perak, 20,879 piculs for Selangor, 285 piculs for Negri Sembilan, and 659 piculs for Pahang, a total of 71,981 piculs valued at $462,870, Singapore money.

The increase in the rubber acreage during the year was 10,539 acres in Perak, 20,694 acres in Selangor, 9,649 in Negri Sembilan, and 931 acres in Pahang. Rubber has now become the most important form of cultivation in the Federated Malay States and the acreage under rubber is much in excess of that of any other form of cultivation. The number of rubber estates is given as 300 with an acreage of 455,596, of which 168,048 acres are actually planted with rubber. The number of trees is given as 26,165,310, and the output of dry rubber as 1,425 tons, which was only 885 tons in 1907.

The planting of Para rubber (*Hevea braziliensis*) has almost entirely superseded that of rambong (*Ficus elastica*). The greatest difficulties which the planters have met during the year have been the ravages of the white ants (*Termes ges troi*), and a fungoid disease known as *Fomes semistostus*. It is estimated that over 57,000 people are employed on the rubber estates in the Federated Malay States.

Over 10,000 acres are devoted to raising tapioca, *Manihot utilissima* (cassava, "kamoteng kahoy"). The low prices prevailing during the year discouraged this cultivation and it is alleged that in some places farmers did not think it worth while to harvest their crop. It is being used to a considerable extent as a catch crop in connection with rubber. During the early months of 1908 the price of Para rubber fell to as low as 3 shillings, but during the latter months it showed a substantial increase until the year closed with the market at 5 shillings and 9 pence. During 1909 the price has been gradually improving up to the month of August when good sheet was quoted at 8 shillings. There is no indication of a sudden drop in prices and it is believed that the close of 1909 will show an average price per pound greatly in advance for that quoted in 1908.

RUBBER IN BRITISH NORTH BORNEO.

At the end of 1908 there were ten companies planting rubber in British North Borneo. The total area of land owned by these companies amounted to 87,000 acres excluding the properties of the North Borneo

Trading Company which amount to 94,000 acres, of which approximately 6,000 acres are planted with Para rubber. According to the report of the commissioner of lands for British Borneo, the Sekong estate which is the only one that has reached the productive stage, was sold in June by the North Borneo Company to the Sekong Rubber Company, the price paid being £40,000. In November, 1908, the government sold the Lumat estate to the North Borneo State Rubber Company, Limited, for £25,000. During the year 1908, the Tenom Borneo Company, who own an estate of 3,000 acres at Beaufort, opened a further 2,000 acres at Menggatal north of Jesselton. Owing to the gradual rise in the price of rubber during the year the planters of British North Borneo are optimistic and Borneo now takes its place among the rubber-producing countries of the world.

INTERNATIONAL EXPOSITION IN JAPAN IN 1912.

The official Japanese announcement of the Grand Exhibition of Japan, which will be opened in Tokyo on April 1, 1912, and closed on October 31, contains rules and regulations regarding the allotment of space for exhibits. The exhibition will be held on the Aoyama Parade Grounds, in the city of Tokyo, and include the first, second, and third blocks of Kitamachi, Aoyama, about three-quarters of the imperial estate of Yoyogi, Toyotama district, Tokyo Prefecture. The entire site of the exhibition will contain about 292 acres. All foreign governments and peoples are invited to participate in this exhibition. For the installment of foreign exhibitions belonging to the five different departments of education, science, machinery, electricity, and manufactured goods, space will be allotted in the exhibition buildings to be erected by the administration office of the exhibition. For exhibits other than these any nation may erect a separate building at its own expense, and no charge will be made for the space allotted for the building. All articles imported from foreign countries for the sole purpose of the exhibition and not for commerce, and all materials for the buildings of foreign governments will be admitted free of duty. It is also intended to afford special protection to all inventions, designs, models and trade-marks of foreign exhibits.

IRRIGATION IN BRITISH INDIA.

According to Consul-General William H. Michael of Calcutta, the British Indian government proposes to link together the five rivers or the Punjab (punjab means five rivers)—the Indus, Jelum, Chenab, Beas, Ravi and Sutlej—in such a manner as to equalize the flow of water when one river or more is in flood, and thus supply the whole canal system connected with these rivers. When the great irrigation project in the Punjab, now in course of construction, has been completed the irrigation department will take up the scheme of drawing and

rendering fit for cultivation the lowlands and salt marshes which make up what is known as the Runn of Cutch. It is claimed that the irrigation department has work on plans that have been adopted to engage its time, energies, and available capital for thirty years.

CACAO TRADE.

Consul José de Olivares of Managua, Nicaragua, states that while cacao ranks in importance after both coffee and sugar it is recognized as the surest and most remunerative product than can be grown in the districts to which it is adapted. Lands suitable for cacao growing may be had at from $5 to $50 gold per acre, according to locations and facilities for the transportation of crops. The cost of clearing, planting, and maintaining cacao land for the first five years ranges from $200 to $250 gold per acre. The cost for caring and maintenance after the trees come into bearing ranges from $2.50 to $5, gold, per acre. Two classes of cacao trees are cultivated in Nicaragua. One of which is indigenous to the country and bears within six to eight years, the other, a foreign variety, bears within four years from the time of planting.

The Nicaragua Government encourages the industry by offering a premium equivalent to 2 cents, gold, for every tree planted, payable upon its coming into bearing. The average yield of the cacao tree at the time it is in full bearing is 2 pounds of beans, or about 600 pounds to the acre. At present there is practically no cacao exported from Nicaragua, the entire production being consumed in that country where it readily sells for from 20 to 25 cents, gold, per pound.

The cacao production of Santo Thome and Principe is becoming more important each year. These islands produce only one variety, fine African or superior Thome. Last year this variety sold as high as 28 cents, gold, per pound. For a cocoa of medium fine quality, manufacturers claim that Santo Thome is perhaps the most reliable on the market. It is graded according to quality. The second grade is called "paiol" and is the poorly cured cacao raised by the small negro farmers. The third grade is called "colha" and consists of the broken beans and beans of poor quality sorted from good cacao. The receipts of cacao at Lisbon from the colonies in 1908 amounted to 477,175 bags as against 402,221 bags in 1907, each bag weighing 132 pounds, approximately 1 picul. At least one-fifth of the crop of Santo Thome and Principe is exported to the United States through Lisbon. The value of the declared exports to the United States during 1907 and 1908 amount to $1,571,851, United States currency for 1907 and $1,717,708, United States currency for 1908. The amount exported to the United States in 1908 was 91,869 bags or about 12,127,000 pounds.

Cacao production forms the premier agricultural industry of Santo Domingo. In 1907 there were exported 9,983 tons. In 1908 there was

a considerable increase in the output. Santo Domingo possesses extensive areas admirably adapted in every way for cacao cultivation and it is anticipated that it will soon take the second or third rank of the cacao-producing countries of the world. The average yield is 4 pounds per tree which compares favorably with the yields in other countries where advanced methods of culture are practiced.

With the object of extending the knowledge of the cacao industry, Tropical Life has arranged to offer a prize of ₱50 for the best essay on the subject. The essay in question should take the form of a popular scientific treatise.

The United States is the largest consumer of cacao in the world, the output of which is only 340,000,000 pounds. The leading countries exporting to the American market are the British West Indies, Bermuda, Brazil, and South America. It would seem that the Philippine Islands might reasonably enjoy a large trade with the United States if steps were taken to develop the cacao industry of the Islands.

KOREAN TOBACCO MARKET.

According to Consul-General Thomas Sammons' Korea's native population is estimated at about 9,000,000, 3,800,000 of whom are tobacco smokers, consuming annually 49,478,997 pounds of tobacco. The tobacco used is mostly of native production, although $600,000 worth of foreign tobacco is sold in Korea each year. About one-half of this is supplied by Japanese imports and the remainder are American and British products. It would seem that it would be an easy matter for the cigar manufacturers of the Philippine Islands to find a ready market for their products in Korea.

NATIONAL RICE EXHIBITION OF SIAM.

The first national exhibition of Siam rice was opened on March 11 in Bangkok by the Crown Prince of Siam. The rice was arranged in rows of tiers, and at the foot of each row was a more than life-size figure of the Buddha. There were nearly 3,000 exhibits from the various parts of Siam. Each district's exhibits were placed together, the exhibitor placing his rice in a neat little bamboo basket, sack, or glass jar, according to his taste. Each receptacle was neatly labeled showing the name of the owner, district, and kind of rice.

The following prizes were offered for the best rice in each district: Best, 400 *ticals* (1 *tical*=36 cents, gold); second best, 200 *ticals;* third best, 100 *ticals.*

The first prize and a silver vase were awarded to the exhibitor of the best rice at the exhibition. The trophy remains in the custody of the high commissioner for the district of the winning cultivator for one year. If won three times in sucession it becomes the absolute property

of the winner. The judges award a maximum of 90 marks in deciding the winners of the various prizes as follows:

	Marks.
1. Long grain	10
2. Size of grain	10
3. Clearness	10
4. Whiteness of grain	10
5. Thinness of husk	10
6. Thinness of case under husk	10
7. Luster	10
8. Regular size	10
9. Weight	10

The rice crop is of enormous importance in Siam as rice and fish form the principal food for the people. The Siam rice is said to be of excellent quality and wherever introduced it has found a ready market. The one export now reaches from 700,000 to 900,000 tons. It is estimated that about 2,000,000 people are engaged in the cultivation of rice, and many thousands more in getting it ready for market. The reaping in Siam is done mostly with sickles and the thrashing by the treading of cattle and buffalo, while the grain is thoroughly cleaned in the wind. At present machinery is being introduced for plowing, harvesting, and thrashing of rice which is readily gaining favor among the farmers. This exhibit will be repeated yearly and affords an excellent opportunity for exhibiting machinery as well as the products of the rice farms.

ROBUSTA COFFEE IN JAVA.

A new variety of coffee known as "robusta," which was discovered some years ago growing wild on the estates in Africa, is being grown very successfully in Java. Inasmuch as no satisfactory results were obtained from growing the plant in the Kongo region some specimens were sent to the Botanical Garden at Brussels and from there a number of plants were sent in Ward cases to Java in 1902. The results of the cultivation of this coffee have been wonderful and it is reported that in several cases the success of this cultivation has saved old coffee estates from ruin. It is said that it thrives on ground where Arabian and Liberian coffee have ceased to yield a satisfactory product. Ordinarily Arabian coffee yields its first crop at four years, such yield being about 4 piculs per *bouw* (1 *bouw*=$1\frac{3}{4}$ acres). The robusta coffee planted in east Java yields after three years from 10 to 12 piculs per *bouw* and on some estates during the past year five-year old trees have produced 20 to 25 piculs per *bouw,* this being regarded as a record yield. Robusta coffee trees are planted about 6 feet apart and topped at about $5\frac{1}{2}$ feet high. Young plants require shade trees. The bean is very small and for the first two crops rather lacking the aroma usually found in coffee. The later crops, however, appear to improve in taste and aroma. The Netherlands Indian Government is encouraging the

cultivation of robusta coffee by establishing nurseries in different districts and distributing young plants free to the natives for planting. Seeds of the robusta coffee have been sent to the coffee estates in Brazil for experimental purposes, the results of which are not yet known. The output of robusta coffee for 1908 is given as 1,600 piculs. The price quoted for this article is $14.07 U. S. currency per picul. Only small quantities have as yet been exported.

CARAVONICA COTTON IN MEXICO.

According to Special Agent W. Graham Clark, who has been investigating textile trade conditions in Mexico, the Caravonica cotton tree can be grown in that country with a good prospect of profit from its cultivation. Caravonica cotton was produced by the crossing of a fine long stapled Mexican cotton with a coarse long stapled Peruvian cotton. This hybridization was carried out in Queensland some ten years ago by an Italian scientist, Dr. David Thomatis, and since then seed from the resulting plants has been tried in all parts of the world. It is now being experimented with in Mexico, India, Egypt, French New Caledonia, and the Kongo. Experiments in upper Mexico and the United States have been proven failures, but in lower Mexico the plant grows well. It has been demonstrated that the plant will grow only in a hot climate with not too much rainfall. There are two varieties of the Caravonica cotton, one known as "wool Caravonica," which is adapted for mixing with wool, and the other which is more valuable, known as "silk Caravonica," which has a long silky fiber of great strength, that can be mixed without detection with some qualities of silk. Caravonica cotton has a black seed similar to that of Egyptian cotton, and the seed comes out clean and flossless from the gin. The tree or bush will grow to 20 feet or more in height but it is usually trimmed every year. It begins to bear at seven to eight months after sowing, and will yield profitably without replanting for from five to eight years. In starting a plantation the land has to be very carefully prepared, but after that it needs little cultivation beyond weeding under the trees. Trees are planted in rows, 7 feet apart each way, which gives about 900 trees to the acre. With an average of 300 to 500 bolls, each tree will bear from 4 to 7 pounds of seed cotton, or about $1\frac{1}{3}$ to $2\frac{1}{2}$ pounds of clean floss. Under favorable conditions Caravonica cotton in Mexico has yielded as high as 1,200 pounds of clean lint per acre. The cotton is usually gathered from January to May. The bolls on large trees run about 50 to a pound, and this large size of bolls diminishes the difficulty of picking from such high bushes.

This tree has been found to be very healthy and highly resistant to pests of all kinds. Experimental lots of silk Caravonica have been shipped to Liverpool and a slightly higher price than that paid for sea island was obtained. It is believed that the success of this plant has

been satisfactorily demonstrated in Mexico; the product is of a much longer staple and better variety than that of other cotton trees of the country.

BRUSSELS UNIVERSAL AND INTERNATIONAL EXHIBITION 1910.

This office is just in receipt of an announcement, through the consul for Belgium, of the Brussels Universal and International Exhibition in connection with which will be held the first International Congress of Agricultural Associations. The Government of the Philippine Islands has been invited through the Belgium legation at Washington to apoint special delegates to this meeting. The number of agricultural associations has greatly multiplied in all parts of the world, and in every country the agricultural classes form a greater or less part of the whole population. The Government of Belgium desires to invite all agricultural associations and everyone interested in the progress of the people who lives in the country to attend the first international congress which will be held in Brussels in 1910. The admission fee is 15 *francs* which will be sent to M. Vandervaeren, 220 Chaussée d'Alsemberg, Brussels, Belgium. There will be eight sections of the congress which will hold separate meetings as follows: The general association composed of the branches, (1) association of agriculturists, (2) association of producers, (3) association of dealers, (4) credit associations, (5) rural hygiene, (6) rural highways, (7) agricultural labor, (8) statistics and documents.

The exposition will open in Brussels in April, 1910, and will last about six months. Its places and halls will be erected in the new quarter of the Avenue Louise. The programme contains special exhibitions, temporary agricultural and horticultural shows, congresses, conferences, etc. The exhibition ground will cover a total area of about 200 acres, a large portion of which will be reserved for the foreign sections. The principal palace and the halls of the exhibition will be built of iron. The roofed surface amounting to at least 15 hectares or about 37 acres. For the protection of exhibitors measures will be taken by the Government of Belgium for protecting patentable inventions. Foreign goods intended for the exhibition will be allowed provisional duty-free importation subject to being afterwards exported. The exhibition is not organized with a view to profit.

An international jury of awards will be appointed by the respective governments represented. The jury will be organized and controlled by the commissioner-general of the Belgium Government. The plan of the agricultural exhibit is as follows: (1) Rural husbandry, plant and methods, (2) viticultural implements and methods, (3) agricultural implements and methods, (4) agronomy, agricultural statistics, (5) agricultural products of vegetable origin used as food stuffs, (6) agri-

cultural products of animal origin used as food stuffs, (7) nonedible agricultural produce, (8) useful insects and their products, (9) noxious insects and vegetable parasites.

SUGAR IN PORTO RICO.

The sugar crop for 1909 in Porto Rico is estimated at from 205,000 to 225,000 tons, which indicates that a very great advance has been made in the output during the last seven or eight years. The probable limit of the sugar production of the Island of Porto Rico is supposed to be about 500,000 tons. The latter figure will be reached, it is believed, by increasing the area now planted to sugar cane rather than by the introduction of improved machinery, which would considerably increase the amount of sugar produced from the area which is at present planted.

An experiment station is to be established, and an extensive irrigation system, which will water several thousand acres of land, has been begun. There are now three central sugar factories in Porto Rico which use twelve-roller mills, and another is in course of construction.

SUGAR INDUSTRY IN BRITISH INDIA.

The official estimate of the sugar crop of Britsh India for the year 1909 gives the total area under sugar cane in the seven provinces of British India as 2,184,000 acres. The yield from this was 1,841,800 tons of crude sugar, or considerably less than 1 ton per acre. However the chief sugar districts of British India are situated in the united provinces where over 50 per cent of the total sugar crop of the country is produced. The acreage for the year 1908–9 was 1,119,400 acres and the yield of raw sugar was 843,700 tons. In Bengal the area is estimated at 375,000 acres and the yield obtained was 255,800 tons in 1908–9. In the three sections above mentioned the acreage has fallen largely during the past year, and the crops suffered considerably from drought and insects.

In the Punjab where about 12 per cent of the sugar crop is produced the people were fortunate in having good rains. Eastern Bengal, Madras, and Assam also suffered from drought and as a result the sugar crop is much smaller for the past year.

SUGAR PRODUCTION AND BUD-ROT IN CUBA.

During the past season there have been 186 sugar factories in operation in Cuba. Of these, 72 are owned by Cuban, 36 by American, and 76 by English, French, and Spanish capitalists. The average area of cane raised for each factory is about 4,500 acres and the average output of sugar for each factory is about 8,100 tons. The sugar acreage of Cuba has doubled during the past year.

The Government of Cuba has appropriated $7,000 for the expenses of the campaign against the bud-rot disease on the island.

AGRICULTURAL CONDITIONS FOR JULY.

The typhoon season now at hand is, not without reason, a cause of apprehension to experienced farmers who in the past have seen their crops uprooted by the wind and often floated from inundated fields by overflowing rivers. During the last days of July it rained heavily over almost the entire Island of Luzon, with strong winds which in some regions increased to the severity of baguios. The crops most affected were palay, corn, and camotes at Santa Catalina and Lapog in Ilocos Sur; Balanga, Orani, and Pilar in Bataan; Alava, Bautista, Rosales, San Carlos, Santa Barbara, Santo Tomás, and Urbiztondo in Pangasinan; Gapan and Santa Rosa in Nueva Ecija; Camiling and Paniqui in Tarlac; Bocaue and San Rafael in Bulacan; also a few other municipalities in Pampanga, Rizal, Cavite, Ambos Camarines, and Sorsogon. In Cagayan and Ilocos Sur in Luzon, and in some provinces of Negros many fields have been inundated and growing crops destroyed.

On the other hand, in Zambales and in some parts of Union, Albay, and Tayabas, the general condition of the crops is good, especially in the province last named; in most localities but slight damage has been done by the wind and rain. Then, too, while the rains on Luzon have been very abundant, they have not yet become general in Iloilo, Bohol, Cebu, and Negros, where drought still prevails in some parts, damaging the palay fields, although it favors the crops of corn and sugar cane. In some of the municipalities of Samar, also, the drought is still causing damage, and in certain parts of the Provinces of Rizal, Bulacan, and Cavite crops have already been affected by the excessive heat.

In Luzon fewer complaints are being made of the destruction of crops by locusts; they are still reported, however, from Bataan, Rizal, Laguna, Cavite, and Batangas, where small flights of them continue to cause damage. In Iloilo, Bohol, Cebu, and Oriental Negros they seem to be firmly established, for although they disappear from some municipalities, to the great satisfaction of the farmers, they reappear at the end of a few weeks. In Occidental Negros, however, there are some farmers who have succeeded in destroying them, or compelling them to fly away without reappearing.

In Ambos Camarines rats are doing less damage than earlier in the year, but from Batangas come reports of persistent and extensive inroads made on the crops by these pests.

PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS, AUGUST 1909.

IMPORTS.

Articles.		Units.	Manila.	Cebu.	Iloilo.	Jolo.	Zamboanga.	Balabac.	Davao.	Total.
Rice	Value	Dollars	337,957	165,995	49,901	3,568	13,925			571,346
	Quantity	Kilos	12,909,836	5,828,242	2,081,730	94,574	387,181			21,301,563
Beef cattle	Value	Dollars	71,057	3,635	1,000		243			75,935
	Quantity	Numbers	3,945	149	49		10			4,153
Hogs	Value	Value	269		4					273
	Quantity	Numbers	37		2					39
Eggs	Value	Dollars	24,235		9		75			24,319
	Quantity	Kilos	191,672		219		408			192,299
Sugar	Value	Dollars	11,360	1,823	873	455	322			14,833
	Quantity	Kilos	167,011	24,862	13,861	7,316	5,059			218,109
Coffee	Value	Dollars	19,812	181	404	243	420			21,060
	Quantity	Kilos	92,155	1,104	2,182	888	1,707			98,036
Cacao	Value	Dollars	17,203	2,232	67					19,502
	Quantity	Kilos	71,238	7,888	69					79,195
Raw cotton	Value	Dollars	9,185							9,185
	Quantity	Kilos	36,649							36,649

EXPORTS.

Hemp	Value	Dollars	1,560,715	516,032		240	141			2,077,128
	Quantity	Kilos	15,547,123	4,991,627		2,400	1,200			20,542,350
Sugar	Value	Dollars	17,278	43,775	255,510					316,563
	Quantity	Kilos	404,951	964,444	5,600,875					6,970,270
Copra	Value	Dollars	325,729	86,600	18,145	4,319	21,273			456,066
	Quantity	Kilos	6,027,531	1,100,228	229,607	58,469	242,047			7,657,882
Tobacco	Value	Dollars	154,688							154,688
	Quantity	Kilos	1,146,559							1,146,559
Cigars	Value	Dollars	127,125							127,125
	Quantity	Thousands	12,320							12,320
Cigarettes	Value	Dollars	1,059							1,059
	Quantity	Thousands	1,069							1,069

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES, AUGUST, 1909.

[Temperature and total rainfall for twenty-four hours beginning at 6 a. m. each day.]

Date.	Hemp.				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.						Aparri.		San Fernando.	
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	28.5	0.8	28.8	0.0	27.4	16.0	28.2	0.0	27.5	0.0	28.4	11.2
2	28.8	6.8	28.3	1.0	27.2	1.5	27.9	0.0	27.4	3.3	27.0	4.1
3	27.9	1.0	28.0	2.5	26.3	2.0	27.1	0.0	25.7	34.8	27.4	0.0
4	27.7	0.0	27.7	9.1	27.2	3.0	28.4	14.0	26.2	26.9	28.2	11.0
5	27.5	0.0	28.2	7.4	27.1	1.0	27.8	8.9	26.6	0.3	27.6	27.7
6	28.5	0.0	28.8	0.0	27.8	2.5	26.3	2.3	27.4	0.0	27.6	3.7
7	28.8	0.0	28.8	2.5	27.6	0.0	28.6	0.0	27.8	0.8	28.6	0.0
8	28.6	0.0	28.4	0.0	27.4	0.0	28.0	1.0	28.4	0.0	28.9	0.0
9	28.7	0.0	28.6	0.0	27.1	0.0	26.4	0.0	28.2	0.0	28.5	0.0
10	28.5	0.0	28.4	3.0	27.5	0.0	28.2	0.0	28.2	0.0	29.2	0.0
11	28.5	0.0	27.4	27.5	27.5	0.0	28.2	0.0	28.8	0.0	29.0	0.0
12	28.7	0.0	28.4	0.0	26.7	0.0	28.2	0.3	28.1	0.0	29.4	0.0
13	27.8	0.5	28.4	0.0	27.3	1.0	28.6	0.0	28.4	0.0	29.1	0.0
14	27.2	0.0	25.8	10.9	25.2	6.6	29.5	0.8	28.1	0.0	28.8	0.0
15	28.0	0.0	27.6	0.0	26.8	0.0	28.0	43.9	27.8	0.0	28.4	0.0
16	27.3	3.0	27.9	0.0	27.0	0.0	27.4	8.5	28.0	0.0	28.6	0.0
17	27.2	1.0	28.2	3.8	27.4	1.5	27.8	28.4	28.3	0.0	28.0	10.0
18	26.7	3.0	26.3	0.0	25.8	3.3	27.8	7.3	28.1	31.0	27.7	5.1
19	26.2	12.7	27.4	0.0	26.6	0.0	27.6	28.7	26.8	15.2	27.2	7.4
20	27.3	0.0	28.5	0.0	27.2	0.0	28.5	0.0	26.6	0.0	27.8	1.0
21	28.6	0.0	28.3	2.3	27.0	0.0	28.4	17.0	26.8	2.5	28.0	0.0
22	28.8	0.0	26.5	9.6	27.0	11.7	28.6	30.2	27.1	0.0	27.8	6.4
23	28.5	3.8	26.6	6.6	28.1	0.0	28.6	0.0	27.9	0.0	27.6	0.0
24	29.3	2.5	26.9	6.4	27.5	11.4	29.1	0.0	28.6	0.0	29.1	0.0
25	28.8	0.0	26.5	21.8	26.1	10.7	29.8	2.0	28.0	0.0	28.7	0.0
26	28.2	0.0	26.8	0.0	26.8	0.0	29.8	1.5	28.3	0.0	29.0	0.0
27	28.2	1.0	28.3	0.0	28.2	0.3	29.4	32.4	28.6	0.0	29.4	1.5
28	28.7	0.3	28.6	0.0	28.3	0.0	29.0	0.0	27.0	0.3	28.6	0.0
29	29.1	0.0	28.7	0.0	28.5	0.0	29.2	1.1	27.9	0.0	29.0	1.0
30	27.6	0.5	27.4	1.8	28.2	0.3	29.0	7.2	27.6	0.0	28.3	0.0
31	27.7	3.3	26.9	29.9	28.0	0.0	27.5	0.0	28.0	0.0	29.1	0.0

RANGE OF PRICES OF PHILIPPINE AGRICULTURAL PRODUCTS.

Highest and lowest prices of unhulled rice, abaca, copra, sugar, tobacco, and corn for the month of July, 1909.

[NOTE.—75 liters=1 cavan; 63.25 kilos=1 picul; 46 kilos=1 quintal.]

Province.	Unhulled rice per 75 liters.		Abaca per 63.25 kilos.		Copra per 63.25 kilos.		Sugar per 63.25 kilos.		Tobacco per 46 kilos.		Corn per 75 liters.		General condition of crops.
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	
Agusan			₱6.30	₱6.30									Good.
Albay	₱3.25	₱2.00	9.50	7.50	₱7.50	₱6.00					₱5.00	₱2.50	Good.
Ambos Camarines	3.75	2.50	10.25	6.00	9.51	6.00	₱8.00	₱3.75			3.00	1.87	Fair.
Antique	3.12	1.75	18.00	10.00	7.70	6.00	4.50	3.00	₱25.00	₱12.00	2.50	1.00	Good.
Bataan	2.50	1.75					6.50	5.00			4.50	2.00	Fair.
Batangas	4.00	2.00	11.00	5.00			5.00	3.00	11.00	6.00	3.50	1.80	Good.
Bohol	3.75	3.00	12.00	7.00	9.00	7.12	5.00	4.00	10.00	8.00	3.90	2.50	Fair.
Bulacan	2.75	2.40					7.00	7.00	20.00	20.00	2.50	2.00	Fair.
Cagayan	4.50	3.50							13.00	7.00	3.50	2.25	Good.
Capiz	3.75	2.00	14.00	8.00	7.59	5.50	6.00	3.00	8.00	4.00	5.00	1.00	Good.
Cavite	3.00	2.50									2.00	2.00	Poor.
Cebu	4.00	2.50	15.00	8.00	11.50	7.00	8.00	3.00	28.00	3.00	5.00	3.00	Fair.
Ilocos Norte	5.00	3.00							6.00	4.00	3.00	1.00	Good.
Ilocos Sur	5.00	2.75			10.00	10.00	3.00	2.25	25.00	2.30	5.00	1.50	Fair.
Iloilo	3.50	2.50	18.00	18.00	9.30	7.00	5.75	3.50	35.00	3.50	3.00	2.50	Good.
La Laguna	3.00	2.40	6.00	6.00	7.25	5.50	5.00	4.00			3.00	1.50	Fair.
La Union	3.37	2.50			6.00	6.00	4.50	3.00	9.00	4.87	4.75	4.00	Good.
Leyte	3.75	2.00	12.50	9.00	8.00	6.00	6.00	4.50	30.00	10.00	3.50	3.00	Good.
Mindoro	5.00	4.00	10.00	10.00					7.50	7.50	2.50	2.00	Fair.
Misamis	3.00	3.00	7.50	7.50	9.00	9.00	4.00	4.00			4.00	4.00	Good.
Moro Province	4.00	2.50	10.00	6.60	8.50	7.50	5.75	5.75			2.50	2.50	Fair.
Mountain Province	4.00	3.00					6.00	3.50	4.50	2.50	4.00	2.50	Fair.
Nueva Ecija	2.50	1.25					8.00	4.00	20.00	7.00	2.00	1.00	Good.
Nueva Vizcaya	3.00	2.50							20.00	20.00	3.00	3.00	Good.
Negros Occidental	3.12	3.00	12.00	11.00	7.40	6.00	5.25	4.00	35.00	35.00	5.00	2.00	Fair.
Negros Oriental	3.75	2.50	10.00	6.00	9.50	7.50	4.50	4.50	25.00	4.75	5.00	4.00	Fair.
Palawan			11.00	11.00	6.50	6.50			20.00	20.00			Fair.
Pampanga	2.40	2.25					6.00	4.50			2.50	1.25	Good.
Pangasinan	2.75	1.80			7.50	5.00	8.00	2.75	16.00	4.00	5.00	1.50	Fair.
Rizal	2.80	2.00	18.00	18.00			7.70	4.20			4.00	2.00	Fair.
Samar	3.75	2.00	13.00	6.00	7.75	6.00			20.00	7.00	3.50	2.00	Good.
Sorsogon	3.00	2.50	12.50	5.50	7.50	4.50	8.00	3.00	7.00	7.00	3.00	2.50	Fair.
Surigao	3.00	1.75	11.00	9.00	8.50	7.00					1.50	1.50	Good.
Tarlac	2.50	2.00	6.00	6.00			5.50	4.00	9.00	9.00	2.50	1.25	Good.
Tayabas	3.25	2.50	10.00	6.00	7.00	4.50			7.00	7.00	5.50	2.40	Good.
Zambales	2.50	1.75			5.00	5.00	5.00	4.00	12.50	12.50	5.00	1.50	Good.

PERIODICALS IN THE LIBRARY OF THE BUREAU OF AGRICULTURE.

Everyone interested in the study of tropical agriculture is invited to visit the library and make use of these periodicals.

ENGLISH.

GENERAL.

Agricultural Bulletin of the Straits and Federated Malay States, Singapore.
The Queensland Agricultural Journal, Brisbane, Australia.
The Agricultural Gazette, Sydney, New South Wales.
Journal of the Department of Agriculture of Victoria, Melbourne, Australia.
Journal of the Department of Agriculture of Western Australia, Perth.
Journal of the College of Agriculture, Tokyo, Japan.
Hawaiian Forester and Agriculturist, Honolulu, Territory of Hawaii.
Tropical Agriculturist, Colombo, Ceylon.
The Agricultural Journal of India, Calcutta.
Memoirs of the Department of Agriculture, Calcutta, India.
Natal Agricultural Journal, Pietermaritzburg, Natal, South Africa.
Agricultural News, Bridgetown, Barbados.
West Indian Bulletin, Bridgetown, Barbados.
The Cuba Review, New York.
Bulletin of the Department of Agriculture, Kingston, Jamaica.
Journal of the Jamaica Agricultural Society, Kingston.
Bulletin of Agricultural Information, Trinidad.
Journal of the Board of Agriculture of British Guiana, Georgetown.
California Cultivator, Los Angeles, California.
The Rural Californian, Los Angeles, California.
Farmer and Fruit Grower, Jacksonville, Florida.
Louisiana Planter, New Orleans, Louisiana.
Southern Cultivator, Atlanta, Georgia.
Progressive Farmer, Raleigh, North Carolina.
Farmer's Guide, Huntington, Indiana.
Kansas Farmer, Topeka, Kansas.
Farm Press, Chicago, Illinois.
The American Florist, Chicago and New York.
The Feather, Washington, D. C.
The American Thresherman, Madison, Wisconsin.
Oregon Agriculturist, Portland, Oregon.
Journal of Agriculture and Horticulture, Montreal, Canada.
The Gardeners' Chronicle, London.
Commercial America, Philadelphia, Pennsylvania.
Tropical Life, London, England.
Horn and Hoof, Seattle, Washington.
The Breeders' Gazette, Chicago, Illinois.
The Journal of Tropical Veterinary Science, Calcutta, India.
American Veterinary Review, New York.

REPORTS AND QUOTATIONS.

Crop Reporter, by the Secretary of Agriculture, Washington, D. C.
Monthly Consular and Trade Reports, Washington, D. C.
Federal Reporter, New York, N. Y.
Smith and Schipper's Monthly Report, New York, N. Y.
Hanson and Orth, Hemp Brokers, Monthly Statement, New York.
Hemp Market Report, Landauer & Co., London.
Ide and Christie's Monthly Circular, London.
Exporters and Importers Journal, Chicago, Illinois.
Quarterly Summary of Commerce of the Philippine Islands, Washington, D. C.
Ker & Co's. Price Current, Manila, Iloilo, and Cebu, P. I.
Weekly Shipping Circular (Sugar), Jose T. Figueras, Iloilo, P. I.

LOCAL.

Official Gazette, Manila, P. I.
Far Eastern Review, Manila, P. I.
Philippine Journal of Science, Manila, P. I.
Weather Bureau Bulletins, Manila, P. I.
The Philippine Agricultural Review, Manila, P. I.

SPANISH.

Boletin de la Cámara de Comercio Filipina, Manila, P. I.
Boletin Oficial de la Secretaría de Agricultura, Comercio y Trabajo, Cuba.
Boletin de Agricultura, San José, Costa Rica.
Hacendado Mexicano, El, Mexico, Mexico.
Hacienda, La, Buffalo, New York.
Industrias Americanas, New York, N. Y.
Revista del Ministerio de Obras Públicas, Bogotá, Colombia.
Agricultor Peruano, El, Lima, Peru.
Revista de la Asociación Rural del Uruguay, Montevideo.
Prácticas Modernas é Industrias Rurales, La Coruña, Spain.
Resumen de Agricultura, Barcelona, Spain.

OTHER LANGUAGES.

Bulletin de la Chambre de Commerce de Saigon, Saigon, Indo-China.
Bulletin Economique, Hanoi-Haiphong, Indo-China.
Chamber d'Agriculture du Tonkin, Hanoi-Haiphong.
Bulletin de Department de l'Agriculture aux Indes Neerlandaises, Java.
L'Agronomie Tropicale, Brussels, Belgium.
Boletim de Agricultura, Sao Paolo, Brazil.
Tamil Journal of South India Agriculture, Madras, India.
Station Agronomique, Port Louis, Colony of Mauritius.
Journal d'Agriculture Tropicale, Paris.
Boletim do Museu Goeldi, Para, Brazil.
O Fazendeiro, Sao Paolo, Brazúl.
Boletim da Sociedade de Geographia de Lisboa, Portugal.

THE PUBLICATIONS OF THE BUREAU OF AGRICULTURE.

The following-named bulletins of the Bureau of Agriculture are available for distribution, and will be sent free of charge to any address upon application. Applicants are requested to state whether all publications of the Bureau are desired as issued, or only those specified. The name and address of the applicant should be plainly written and all communications should be addressed to the Director of Agriculture, Manila, Philippine Islands.

FARMERS' BULLETINS.

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No. 6. Experimental Work with Fungous Diseases of Grasshoppers. (Spanish.)
No. 9. A few Suggestions on the Cultivation of Cotton. (Spanish.)
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No. 12. Abacá. (Manila Hemp.) (English.)
No. 13. The Cultivation of Maguey in the Philippine Islands. (English and Spanish.)
No. 14. The Cultivation of Sesamum in the Philippine Islands. (Spanish.)
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No. 1. Maguey. (English, Spanish, Visayan, Cebuano.)
No. 2. Kapok. (English, Spanish, Tagalog, Visayan, Ilocano, Cebuano.)

PLATE I.—PRINCIPAL ENTRANCE TO THE CARNIVAL GROUNDS.
The Philippine Carnival, February 5 to 14, 1910.

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EDITORIAL.

WHY SHOULD THE FARMERS ATTEND THE CARNIVAL?

For some time past we have been emphasizing the importance of agricultural and industrial expositions for the Philippines, and the particular need of such expositions and meetings of farmers and others engaged in the trade of the country. In this number of the REVIEW we are presenting five articles on this department of the Carnival, namely "The Poultry Show," "The Live-stock Exhibit," "The Provincial and Industrial Exhibits," "The Exhibits by the Bureau of Agriculture," and "The Agricultural Conferences at the Carnival."

After the Philippine Exposition of 1895, up to the time of American occupation, there was so much political unrest that agriculture was largely abandoned. Since American occupation the Insular Government has been chiefly occupied with the problems of maintaining peace and good order, of training the Filipino people to a new form of government, and of educating the coming generation. Under such conditions comparatively little attention has been given to the subjects of agriculture and commerce. As the problems to which the Government has been giving its attention have, in a measure at least, been solved, Government officials and the people at large are awaking to the fact that the country is poor. When compared with other countries of the Far East, such as Java, the Federated Malay States, or Japan, it is seen that the natural wealth and resources of the country are almost wholly undeveloped. Naturally, every one is beginning to ask the question, "What are the natural resources, what constitutes the wealth of the Philippines to which we must look as the foundation for their future progress and prosperity?"

If it is true that lands and agriculture constitute the main foundation for the future wealth and prosperity of the Philippines, then there is every reason why the farmers should attend the Carnival, exhibit their products, and take part in the agricultural conferences. We believe that there could be no better time for such a gathering of farmers, manufacturers, and dealers in the products of the country than that which is planned for at the coming Carnival. Such a meeting of the farmers and leading producers of the country will stimulate a further interest in farming and the productions of the country. Farmers who are cultivating different crops will, through the exhibit of agricultural products at the Carnival, learn something regarding the best varieties of plants to be grown, of better methods of cultivation, and how the present means of transportation can be improved or cheapened. They will learn more regarding the supply and demand for their products, and in every way such an exposition and gathering of those interested in the industries carried on in the country will stimulate the development of these industries, and, we believe, will in time more than double the income of progressive farmers.

The officials of the Bureau of Agriculture wish to become acquainted with as many of the farmers as possible, and to learn directly from them their problems, in a way which will bring the farmers and this branch of the Government into frequent communication, making the Bureau more efficient and enabling the farmers to reap larger profits from their farms. The conferences at the Carnival are sure to bring out many important problems with which farmers in different sections of the Islands have to deal. These problems will be taken up in a serious way by the Bureau of Agriculture and every effort made to solve them as quickly as possible.

The Carnival committees and the people of Manila are making ample preparation for the entertainment of visitors from all parts of the Philippines and foreign countries, but the success of the agricultural and industrial part of the Carnival depends almost entirely on the farmers and the people in the country. They should bear in mind that the Carnival is for them and for the development of their country, and they should give it every possible support.

OUR COUNTRY SAVINGS BANKS.

In this number of the REVIEW we are presenting an article on "The Country People's Bank," by Mr. Willis T. Beardsley, Chief of the Postal Savings Bank, Bureau of Posts. Probably no other single institution, with the possible exception of the schools, is doing more to help the Filipino people on the road to progress and prosperity than the Philippine Postal Savings Bank.

From Mr. Beardsley's article it will be seen that amounts as small as 5 centavos may be deposited in any of the banks in the Islands, which are established in all the principal towns, from Basco in the Batanes Islands to Jolo one of the southernmost islands of the Archipelago. It will be noted that the Postal Savings Bank does everything within its power to encourage the people and the school children to deposit their small savings in some branch of the bank. In fact every effort is made to help small depositors and more attention is given to those who make small deposits than to those who deposit large amounts—the latter being limited to ₱1,000. The Postal Savings Bank is intended to encourage and help the people in the country to save their small earnings. For these savings the Insular Government not only becomes security but it pays interest on deposits at a nominal rate at the expiration of regular interest-bearing periods.

The lesson of saving and making the best use of their savings is one of the most important lessons which the masses of the Filipino people have to learn. Many of them live from day to day, making no provision whatever for the morrow. Under such conditions the country can make

little or no progress. The progress of the country begins with the progress of the individuals in the country. The fundamental needs for the improvement of country life which are the foundation of the future development and progress of the Philippines are, *first,* better food, *second,* better clothing, *third,* more and better thinking, *fourth,* more and better work. These are the fundamental necessities for the improvement of the life of the individual in the country. What the individual eats and wears determines very largely his capacity for physical and intellectual work; what he thinks and does determines his ability and productive power as an economic civic unit, and to the society in which he lives.

At present the masses of the people do not have money to purchase the things necessary for this better living; therefore, each individual must practice economy and self-restraint and lay aside means for his own personal development and progress. The farmer must have not only better food, better clothing and a better home, but he must have better tools to cultivate his farm, he must have money to get the best seeds and plants, and to hire the best help. The storekeeper must keep a better stock and a better store if the country is to make progress. Unless the people of the country lay aside part of their earnings, they have no means for purchasing the things necessary for their own development or for the improvement and development of their lands and property.

We regard the success of the Postal Savings Bank as the most substantial step in the way of progress for the country people. The bank is endeavoring to show the people of the country the importance of saving their money, and until they have learned this lesson we can hope for but little improvement of country life or development of the agricultural, trade, and commercial possibilities of the Philippines.

THE USE OF OUR NATURAL RESOURSES.

One of the most important articles in this number of the REVIEW is that on the San Miguel irrigation project, by Mr. G. K. Larrison, of the Bureau of Public Works. In this article Mr. Larrison touches upon the subjects of water duty, water waste, and what may be accomplished by the economic use of the rainfall of the country accumulated in our natural waterways. Probably in no other part of the world is there a greater waste of natural resources, such as water, lands, and forests, than in the Orient; and we doubt if in any other part of the Orient there is less thought given by the people of the country to the economic use of these abundant gifts of nature than in the Philippines. We have only begun to consider the questions of conservation of soils and forests and of the economic use of our waterways. In a few provinces in northern Luzon the people have given more or less attention to the preservation and economic use of the water in their rivers. Crude irriga-

tion works exist in Tarlac, Nueva Ecija, and in some of the mountain provinces. It is clear to anyone who studies the geography of the Philippines that there are thousands of hectares of land valuable for raising the staple crops of the Islands which could be made to produce larger crops, or from two to three times what they are now producing, by the economic use of waterways and irrigation works such as the San Miguel project described by Mr. Larrison in this number of the REVIEW.

DENATURED ALCOHOL AS A SOURCE OF POWER.

After considerable investigation of the subject, we find that there seems to be a very bright prospect for the production of denatured alcohol for industrial purposes in the Philippines. The Islands furnish an abundance of material for the production of various grades of alcohol, and at present apparently the only problem is that of finding a satisfactory denaturant. Methyl alcohol seems to be the best denaturant and a quantity of this product is on the way from the United States to Manila to be used for denaturizing alcohol made from the sap of the nipa palm. In case this experiment proves a success—and there seems to be little doubt that it will—it is believed that the necessary denaturants can be produced in this country and thus save the large expense for transportation of denaturants from the United States or Europe, which would place denatured alcohol manufactured in the Philippines in a most favorable position to compete with gasoline and similar products which are now being imported into the Islands. For the Philippines it would seem that denatured alcohol should, in the not distant future, largely supplant gasoline and other mineral oils for use as a motor power.

"AGRICULTURE FOR SOUTHERN SCHOOLS."

This Office is just in receipt of a copy of a new text on "Agriculture for Southern Schools," by John Frederick Duggar, director of the Alabama Agricultural Experiment Station and professor of agriculture in the Alabama Polytechnic Institute. This book which is intended primarily for use in schools is published by The Macmillan Company of New York.

In the preface Professor Duggar states that one of the principal objects of the book is to arouse an interest on the part of the pupil in nature and especially in the common plants of the southern farm, orchard, and garden. In that the text treats not only of the fundamental principles of agriculture, but of such subjects as the production of corn, cotton, sugar cane, sweet potatoes, peanuts, and watermelons, it will be of special interest to those who are studying these subjects in the Philippines.

The first chapters of the book treat of the different parts of flowering

plants and take for illustrations such examples as the cotton plant, the tobacco plant, and others familiar to every one in the Philippines. One of its principal features is that it shows how to demonstrate by simple experiments the effect of planting at different depths, and different distances apart, how to test the germinating power of seeds before planting, how plants lift water from the soil, the circulation of the sap through the plant, and the changes in the digestive processes which take place in the leaves.

A chapter is devoted to methods of propagating and improving plants by budding and grafting; another chapter is devoted to the improvement of plants by selection, by cross-pollination, and experiments with different soils. There is also an interesting chapter on soil moisture, giving simple experiments which show the free movement of moisture through the soil, and the heights to which moisture rises in different soils. Chapters are also devoted to explaining how soils become poor, the value of subsoils, how trees and leguminous plants improve the soil, methods of preserving and using composts, manures, and commercial fertilizers. The chapter on selecting and judging seed corn should be most interesting to Philippine farmers. This chapter gives a corn score card and discusses circumference of ears, space between rows, space between the kernels on the cob, corn kernels, and the proportion of corn to the cob. In conclusion it is worth noting that twenty pages are devoted to gardening and two sections to poultry.

In some respects the author of this book seems to have a better appreciation of the difficulties which beset the average student of agriculture than most writers on the subject. The simple experiments given in this text will add greatly to the student's appreciation of the subject and give him a clearer understanding of the fundamental problems in agriculture. In the Philippines we are greatly in need of texts which fully and satisfactorily discuss the staple crops of the country, such as rice, hemp, sugar, coconuts, tobacco, corn, peanuts, etc.

THE POULTRY SHOW AT THE CARNIVAL.

By Maj. GEORGE P. AHERN, *Director of Forestry.*

There will be a poultry show at the next Carnival in Manila. It will be the first of its kind in the Philippines. People will be surprised to learn that there are some fine imported breeds of fowls in these Islands, that the poultry industry can be made very profitable, and that the conditions of soil and climate are favorable to this industry. The experience of a number of people who have raised fine fowls in the Islands has been sufficient to bring out one important fact, namely, that a slight admixture of native blood in the imported fowl produces a breed almost as good, as far as size, form, plumage of bird, and size of eggs, are concerned, and that the mixed breed is better, when we consider hardiness. The difficulties encountered in raising thoroughbred fowls are somewhat discouraging; but as soon as the native blood is introduced, fine, hardy birds result, and the egg production is vastly increased in number and size and value over the native product.

Let those interested in fine fowls get together and assist in making the first exhibition as complete, as interesting, and as instructive as possible. Let us exhibit the imported breed, the mixed breed, and the native fowl, in large comfortable cages, and show the size of eggs from each breed. Let people see for themselves the results of experiments now being made by a few persons in Manila and the provinces.

A great many people would like to know where to get fine fowls and settings of eggs; they would also like to know how to build a cheap chicken house, and how to take proper care of the birds, without undue expense. Some people are now selling eggs at 80 centavos per dozen. Imagine the result to these Islands, financially, if we could raise the egg-producing capacity of native hens from one hundred or less, as it is to-day, to two hundred and twenty or two hundred and fifty per year, as it should be, and as it is in well-regulated yards in the States. This wonderful egg-producing capacity has been brought about largely by poultry exhibitions. We can do the same thing in the Philippines. A slight increase in the egg-producing capacity of our native hens would pay the entire expense of several carnivals.

All through the Middle West of the United States the main source of cash for the small farmer is the chicken house. Why should we

import so many millions of eggs every year? Why should the cold-storage compartment of each vessel entering Manila Bay be packed with fowls for this market when it is well known that the cold-storage egg and fowl can not compare with the fresh local product?

Let all who wish to assist in making the first poultry show a success communicate with the Director of Forestry. Those interested will please inform him of that fact, so that a meeting may be called where all can discuss the project in an informal way. A slight improvement in any one breed of fowls means so much to these Islands that all who are interested are urged to coöperate in making this exhibit a success.

THE LIVE-STOCK EXHIBIT AT THE CARNIVAL.

By C. M. Conner,

Acting Director of Agriculture, Chairman Committee on Live-Stock Exhibit.

Among other new features for the Carnival this year will be an exhibit of live stock. This exhibit will include horses, cattle, goats, hogs, dogs, and poultry.

There is no country located in the tropic where the live-stock industry is developed to the same extent as it is in the temperate zone; there are many reasons for this which need not be discussed here. The live-stock of the Philippine Islands at present is at a low ebb, but it is hoped that in the near future conditions will improve and that the live-stock industry will take its proper place in the agriculture of the Islands. One would be safe in making the statement that there is no country where live-stock as a whole would not bear improving. One would expect this to be true particularly in a country where the products which claim the greater part of the attention of the farmers are other than those pertaining to live-stock raising. Nevertheless, there have been, from time to time, a number of attempts to improve the blood of farm animals in these Islands by the introduction of better blood. These importations have resulted in more or less good and the improvement will be more marked as the farmers learn how to properly care for their animals.

Perhaps the best way of stimulating interest in the improvement of farm animals is to inaugurate contests; all mankind loves a contest, whether it be for a prize of for the honor of winning. When one farmer finds that his neighbor is growing a better class of horses, cattle, or hogs than he does, he naturally inquires as to the care and methods used by his neighbor, and will adopt them if he sees his way clear to do so.

There are a number of good animals in these Islands that have been brought in from foreign countries, also a number that have been raised here. If those interested in live-stock will put them in good condition and exhibit them during the Carnival, there is no reason why interest in better horses, cattle, and other farm animals should not be greatly stimulated. In this exhibit native and mestizo animals should

not be neglected because, so far as real benefit to the country is concerned, the native and mestizo horses, cattle, and hogs, are superior to the imported animals.

The Bureau of Agriculture will exhibit such animals as it has that will be of interest to the public, but these animals will not enter the competition for prizes. The Carnival Association will provide quarters for the animals, but exhibitors will be expected to furnish feed and attendance. Suitable ribbons and diplomas will be given as prizes.

It is hoped that those who are interested in the live-stock problem of the Islands, and particularly those who have animals which could be exhibited at the Carnival, will advise the Director of Agriculture as to their ideas regarding these exhibits, what part they expect to take in them, and the number and kind of animals they will exhibit. It is necessary that information of this kind be at hand in order that the committee may know what preparations to make.

A classification list showing what class of animals may be entered will be issued as soon as practicable. This list may be had by application to the Director of Agriculture.

PROVINCIAL AND INDUSTRIAL EXHIBITS AT THE CARNIVAL.

[Contributed by The Carnival Publicity Committee.]

Already the plans for the provincial and industrial section of the Carnival to be held in Manila next February have advanced far enough to warrant the statement that it will comprise the most complete exhibit ever got together of the arts, handicrafts, and natural resources of the Philippines.

Hon. Dean C. Worcester, Secretary of the Interior, and Lieut. Col. George D. Long, Philippines Constabulary, are in charge of this work, and they are working with the vim that characterizes the efforts of these gentlemen in everything they undertake.

Mr. Worcester, in a meeting of the chairmen of the permanent Carnival committees held recently, devoted more than an hour to outlining the plans he has for making a success of the department which is in his charge, and he offered a large number of very original and valuable suggestions. One of the best of his suggestions was that the management of the Carnival should construct a building in which lectures upon various subjects may be given with the aid of stereopticon views. These lectures, he explained, should not be more than twenty minutes in length, and should be delivered not only in English and Spanish, but also in Tagalog and the other dialects. It is planned that the lectures will cover a wide range of subjects from tobacco, sugar, and hemp cultivation to up-to-date mining methods. They will be illustrated with colored views showing, for instance, sugar cultivation in Hawaii, methods of mining and treating ores in the United States, and modern forestry methods. These lectures will, without doubt, prove one of the most interesting and valuable features of the Carnival.

The Forestry Bureau will be on hand with a most complete exhibit of Philippine woods, many samples of which will be made up into furniture and other articles, thus giving the visitors from the United States and other foreign countries an opportunity to see just what can be done with the woods of this country. The exhibit will also show methods of logging, and other features connected with modern forestry.

The mining division of the Bureau of Science will make a very extensive exhibit in which will be shown the latest and most improved methods of mining. Models of dredges and stamp mills, as well as big

stamp mills in actual operation crushing ore, will be shown, and many other features pertaining to this industry will be on exhibit in this section.

One of the latest industries to be taken up by the Insular Government is silk culture. This bids fair to soon become one of the principal and most remunerative industries of the Philippines, and the Bureau of Science will make a very exhaustive and comprehensive display of it from the hatching of the silkworm to weaving the finished product.

The Bureau of Agriculture will be represented at the Carnival with a very extensive exhibit in which will be shown samples of the various fibers grown in the Islands, sugar cane, rice, corn, etc. This Bureau will also make an exhibit of the best varieties of live stock. The live-stock section will contain some of the best horses, cows, hogs, and dogs from Australia. These will be brought to Manila by Dr. Gerald McKay, one of the assistant directors general of the Carnival, who is in charge of Carnival affairs in Australia. A horse, dog, and poultry show is being arranged, and it will be one of the most interesting features of the big fiesta.

Arrangements have been made to have the various concerns which are manufacturing hemp and other fiber-stripping machinery give practical demonstrations of their machines on the grounds during the Carnival. Many claims have been set forth regarding the capacity of the hemp-stripping machines to do wonderful things, and it is believed that such a test as they have been invited to make would soon tell which were of most worth to the hemp growers.

The Carnival management hopes that it will be possible to have a general agricultural congress in Manila during the Carnival week, and efforts along that line are already under way. Such meetings are beginning to be very important features in India, the Straits Settlements, and other parts of the Far East, and it is believed that such a conference held in Manila would result in the attendance of a large number of agriculturists.

The Carnival Association has extended an invitation to the delegation from the Associated Chambers of Commerce of the Pacific Coast, which is to pay a visit to China early next year, to be present in Manila during the Carnival season, and this invitation has been supplemented by another one from Governor-General Forbes on behalf of the Government. Private information recently received in Manila leads the Carnival management to believe that the invitations will be accepted, and this will mean that more than 300 of the best known business men of the Pacific coast of the United States, men who represent concerns with millions behind them, will be here. The Carnival will be the means of these men having an opportunity to see for themselves just what is being accomplished in the Islands along agricultural and industrial

lines. Many of the most remunerative industries of these Islands have never been properly developed. It is ridiculous to believe that the beautiful hats, mats, baskets, blankets, beadwork, and a dozen other lines of Philippine handicraft should find no market except such as may exist locally. The representatives of these big commercial concerns having an opportunity to examine such wares right on the Carnival grounds, and to see them made before their eyes, will, no doubt, be interested to such an extent that it will mean a large business in the near future.

Another splendid result that will be achieved by the visit of these business men will be that the producers of such wares as have been enumerated will be able to talk with the buyers and obtain first-hand information as to design, quality, style, value, and quantity. In this way all of their efforts may be intelligently directed toward the production of articles which will bring the highest price abroad.

The management of the Carnival is very desirous of getting into closer touch with the agricultural people all over the provinces, and it it requested that those who are interested in the least way in the Carnival, and all those who desire information regarding the industrial and provincial features of the big show, communicate with Lieut. Col. George D. Long, Philippines Constabulary, Manila.

EXHIBITS BY THE BUREAU OF AGRICULTURE AT THE CARNIVAL.

By the Acting DIRECTOR OF AGRICULTURE.

The following extracts from a circular by the Director of Agriculture, dated September 22, 1909, will give an idea of the preparation which this Bureau is making for its agriculture exhibits at the Carnival:

I have the honor to advise that I am sending you herewith a list of materials that this Bureau wishes to collect for its exhibit at the Carnival which takes place February 5 to 14, 1910. In case you find anything mentioned in this list that is worthy of note, collect samples, pack them carefully, and ship them to this Bureau. Fresh fruits or vegetables should be sent with the greatest dispatch so that they may reach here in good shape and be preserved until the time for the exhibit * * *.

You should make a point of talking "Carnival" to the people whenever you have a chance and work up as much interest as you can. The Carnival authorities expect to have the biggest Carnival this time they have ever had and hope to have a large number of visitors from other countries here at that time.

The following is the list of materials which it is hoped to collect and have for the exhibits of the Bureau of Agriculture:

CROPS.

- Manila hemp:
  - Samples of various grades.
  - Implements used in preparing.
  - Articles manufactured from—
    - Furniture.
    - Rope.
    - Cloth.
    - Harness, etc.
- Maguey:
  - Samples of fiber from varieties.
  - Articles manufactured from—
    - Rope.
    - Twine.
- Sunn hemp (*Crotalaria juncea*):
  - Samples of varieties of growing plants.
- Cabo negro:
  - Samples of fiber—
    - As it comes from the tree.
    - As it is sold.
    - Rope.
    - Roofing material.
- Cabo negro—Continued.—
  - Samples of fiber—Continued.
    - Fruit (preserves).
    - Oil (?).
- Sansaveria:
  - Samples of varieties of growing plants.
- Pandans:
  - Raw materials (different varieties).
  - Manufactured articles—
    - Petates.
    - Hats.
    - Bags.
    - Telescopes (tampipi).
- Buri:
  - Raw material.
  - Manufactured articles—
    - Petates.
    - Hats (various grades).
    - Sacks.
    - Cushions and fancy articles.
    - Sugar.

CROPS—continued.

- Pineapples:
  - Crude fiber.
    - Cloth.
- Cotton:
  - Varieties (samples of fiber).
    - Cloth.
- Kapok:
  - Fiber.
  - Oil (from seed).
  - Photographs illustrating use as telegraph poles and fence posts.
- Sugar cane:
  - Samples of varieties from La Granja.
  - Raw sugar as made by open kettle and refined sugar.
- Rice:
  - One-liter samples of varieties with descriptions of varieties and adaptability.
  - Samples of varieties of entire stalk of as many distinct varieties as can be obtained.
  - Implements used in planting, harvesting, and preparing.
- Corn:
  - One-liter samples of varieties of corn, also samples in the ear.
- Beans and peas:
  - One-liter samples of all native varieties of beans and peas that have commercial value.
- Sesame:
  - Seed (1 quart).
  - Oil.
- Peanuts:
  - Seed.
  - Oil.
- Castor beans:
  - Large-seeded varieties.
  - Small-seeded varieties.
  - Oil from each.
  - Pomace.
- Lumbang:
  - Fruits.
  - Oil.
- Pili:
  - Nuts.
  - Oil.
- Cassava:
  - Flour.
- Coconuts:
  - Fruit.
  - Coir.
  - Copra.
  - Copra cake.
  - Oil (raw).
  - Oil (refined).
  - Baskets.
  - Sugar.
  - Use of shells.
- Tobacco:
  - Samples of all grades.
  - Cigars, cigarettes—
    - Shape.
    - Size.
    - Quality.
    - Value.

FRESH VEGETABLES.

Native fruits and vegetables that are on the market at that time.

LIVE-STOCK EXHIBIT.

- 4 head of Nellore cattle.
- 4 head of mestizo colts.
- 4 head of pigs.
- 4 head of goats (two kinds).

MACHINERY EXHIBIT.

- Hemp machine in operation.
- Maguey machine in operation.

MEETINGS FOR THE BENEFIT OF FARMERS.

A convention of hemp growers, to occupy one morning, in which various problems of hemp growing will be discussed by practical hemp growers and others. It is also suggested that meetings be held for those interested in sugar, copra, and tobacco.

AGRICULTURAL CONFERENCES AT THE CARNIVAL.

By the EDITORS.

The following circular, dated October 11, 1909, by the Director of Agriculture addressed to the members of this Bureau and to everyone interested in the agricultural and industrial exhibits at the Carnival, announces the agricultural conferences for the Carnival and merits the attention of everyone interested in the agricultural and industrial progress of the country:

The board of directors of the Philippine Carnival Association has expressed a desire that agricultural and industrial exhibits, such as the poultry show, the live-stock exhibit, the provincial exhibits, and the agricultural conferences should be one of the most important features of the coming Carnival.

The object of these meetings is to bring together all parties interested in handling the staple products of the Philippine Islands and to have them discuss the best methods of producing, handling, and marketing their products for the mutual benefit of all concerned. A suitable hall, large enough to seat at least five hundred people, with a stereopticon so that talks may be illustrated in case the speakers so desire, will be provided for holding such conferences during the Carnival. All papers dealing with machinery, steam plowing, etc., should be profusely illustrated, in order to give hearers a clear idea of the construction and operation of the various machines.

During the first four or five days of the Carnival it is desired that separate conferences be held of those interested in the growing, manufacturing, and marketing of hemp, sugar, tobacco, rice, and copra. Each conference will be opened with a paper or papers on the leading phases of the industry, after which the problems presented will be open for discussion by those in atendance. Everyone is urged to come prepared to present his views relative to the growing, transportation, and sale of the crops in which he is interested. The sessions of each conference may be continued as long as interest seems to warrant. Competent interpreters will be present so that anyone may express his views on the different subjects presented and have important questions answered.

It is desired that every producer who can attend bring samples of his products to these meetings. A place will be provided for the exhibition of these samples and they will be cared for by the superintendent in charge of the agricultural exhibits. Such information as will be of value to the general public should be placed on a card and attached to each exhibit.

There will be an exhibit of maguey and hemp stripping machines and such other agricultural machinery as it may be possible to collect. These machines will be operated at stated hours during the day, so that all may have a chance to observe the merits and demerits of each machine.

At these conferences it is believed that steps should be taken toward organizing separate and permanent associations of those interested in the production of hemp, sugar, tobacco, rice, and copra; and that a permanent Insular Agricultural Society for the purpose of arranging for future agricultural exhibits and conferences should be formed. In this connection, the attention of hemp growers is invited to the coming fiber congress to be held in Sourabaya, Java, in October, 1910, to which it is believed that representatives and exhibits should be sent from the Philippine Islands.

It is desired that all who feel an interest in the success of these meetings write the Director of Agriculture, stating their views on the subject and making such suggestions as may occur to them for the betterment of the exhibits and the success of the meetings.

The Director of Agriculture will also appreciate it if those who expect to attend will notify him, in order that he may know how large an audience it will be necessary to accommodate.

Very respectfully,

C. M. Conner,
Acting Director of Agriculture.

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THE COUNTRY PEOPLE'S BANK.

By W. T. Beardsley, *Chief, Postal Savings Bank.*

The Postal Savings Bank has been called the "country people's bank," and when the conveniences it affords the people are taken into consideration with another branch of the Postal Service, the money-order division, which serves as the exchange department of the system, it will be seen that the term is really correctly applied, for through the post-office the public is fairly well provided with such banking facilities as are most needed by a large majority of the rural population.

However, the Postal Savings Bank was not established solely to give the people what might be termed banking facilities, but was primarily intended to aid the Government in its efforts in assisting the Filipino people to a higher and more substantial civilization. That was its chief aim, and its greatest effort will be in that direction always.

Some one has said that no people could make substantial progress until they had first learned the lesson of providing for the future. If that is true several thousands of the Filipino people are learning that lesson now, and there is every reason to believe that their numbers will continue to increase.

Every man who opens and maintains a savings account has learned something; he has made a beginning; he has looked beyond the needs of the moment; and he has unquestionably become a more responsible and a better citizen.

The Postal Savings Bank is no longer an experiment but has become a very important factor in the Government's effort to better the condition of the people. It has been established three years and has now 253 local banks with 9,579 depositors with over ₱1,500,000 to their credit. These 9,579 depositors are scattered from Basco in the Batanes Islands to Jolo in the Sulu Archipelago. Of these, 3,413 are Americans and 5,571 Filipinos. In the beginning (and the fact should be significant to our friends in America who are endeavoring to secure a Postal Savings Bank for the United States), the Americans outnumbered all others by four to one, but as fast as the Filipinos learned of the advantages of the system they commenced to patronize it freely until now they outnumber all other nationalities combined by 1,563. At the rate they are now

opening accounts they will outnumber all others by many thousands in a short time.

The bank appeals strongly to people of small income for no certificate of financial standing is required to open an account. A man who deposits one peso is given the same attention and consideration as the larger depositor, and even more as a matter of fact, for postmasters are given strict instructions to afford such depositors every facility possible and assist them in making out their papers.

It is the aim of the bank to encourage a free and unrestricted use of its advantages. While no encouragement is given large depositors there are many men of large means who have seen fit to open accounts in the Postal Savings Bank with a substantial deposit as a sort of permanent nest egg. The absolute security of the deposit, backed as it is by the Government, and the fact that it is always immediately available without any advance notice appeals strongly to them, as it should appeal even more strongly to the man of slender means.

The bank especially invites the accounts of children, and they are encouraged to open and maintain accounts in their own names. Parents would do well to encourage them in this. There is no better way to teach a child habits of thirft and economy than a regular account in the Postal Savings Bank. Parents should not only assist them in opening such accounts but should exercise a constant supervision over them and by regular advice and assistance from time to time help the young depositor to increase his balance by earning small sums and curtailing his expenses, not merely for the accumulation of money but for the self-restraint and reliance that it teaches.

The officials of the public school system have done much in aiding this work among the school children and Governor Forbes, then Secretary of Commerce and Police, gave a large number of cash prizes to them which awakened a lively interest and resulted in many new depositors.

For children and others who are not able to deposit so much as a peso, the bank has provided a series of Postal Savings Bank stamps in 5, 10, and 20 centavo denominations. These stamps may be bought one at a time at any Postal Savings Bank and pasted on cards furnished free by the bank. When all the spaces on the card are filled it may be deposited as ₱1 in cash and a regular deposit book will be issued for it. The bank pays its depositors interest at the rate of 2½ per cent per annum on all deposits not over ₱1,000.

Under the Postal Savings Bank Act (No. 1493) the Government pays the deficit in the running expenses of the bank. It is hoped that this year the bank will be on a self-supporting basis and perhaps even provide a small reserve, after which the interest rate paid to depositors may be increased. Thus it is seen that while the Government pays the deficit in the bank's expenses it does not share in the profits; these go to the depositors in the form of increased interest.

In addition to that most important of all requirements in any savings institution—that of absolute security of every peso on deposit—interest-bearing deposits in the Postal Savings Bank are exempt from taxation of any kind whatever and they are also exempt from execution for debt.

Each depositor's account is good at any of the 253 banks throughout the Islands. A depositor from Aparri may find himself in need of funds at Jolo and he has but to present his deposit book and make application to the postmaster there and the amount he wishes will be authorized to be paid to him as soon as the central office is advised of his needs.

Every depositor in the Postal Savings Bank has in his deposit book a commercial passport which establishes at once the fact that he is a responsible member of the community. Employers are quick to recognize this fact and know that they can place greater reliance on such men.

THE SAN MIGUEL IRRIGATION PROJECT.

By G. K. Larrison, *Associate Member American Society C. E., Assistant Engineer, Irrigation Division, Bureau of Public Works.*

It is announced that the construction of an irrigation project in the vicinity of San Miguel, Province of Tarlac, will be started by the Bureau of Public Works during the coming month of December.

The project involves the expenditure of from ₱275,000 to ₱300,000, and will, when completed, supply enough water to irrigate two crops of rice per year on over 4,000 hectares of land.

A large part of the area to be served is owned by the Compañía Tabacalera, and is only partially cleared. For many years the Compañía Tabacalera has had a sawmill and a logging railway about 16 kilometers long in operation in the vicinity, and has converted the best timber into lumber for their own use and for the Manila market. The better class of timber is now practically exhausted and the land will be cleared and planted in rice. The exhaustion of the timber was foreseen as far back as 1890 when a French engineer, Dumarais, then employed by the company, made a survey and contour map of the larger part of the area, showing a projected irrigation system. Dumarais was killed by the insurrectos in 1896 and since that time the project had not been considered until the Government engineers took it up as a feasible project during the past year.

The proposed system will be supplied with water from the O'Donnell River at a point almost due west and about 5 kilometers from the town of San Miguel. A concrete-and-steel dam will divert the water through reinforced concrete headworks into the main canal. The main canal will pass through the town of San Miguel, cross the Manila Railroad, and separate into six lateral canals to serve the area to be cultivated. The length of the main canal and the main laterals will total about 48 kilometers.

Owing to the excessive floods carried by the O'Donnell River a falling dam will be constructed. A heavy reinforced-concrete floor will be carried on piles at the present bed of the river, and on this twenty-two steel falling gates will be constructed. The gates will be raised to the proper height to divert water into the canal by a chain hoist operated from a car carried on a cableway. In case of a flood they can be dropped

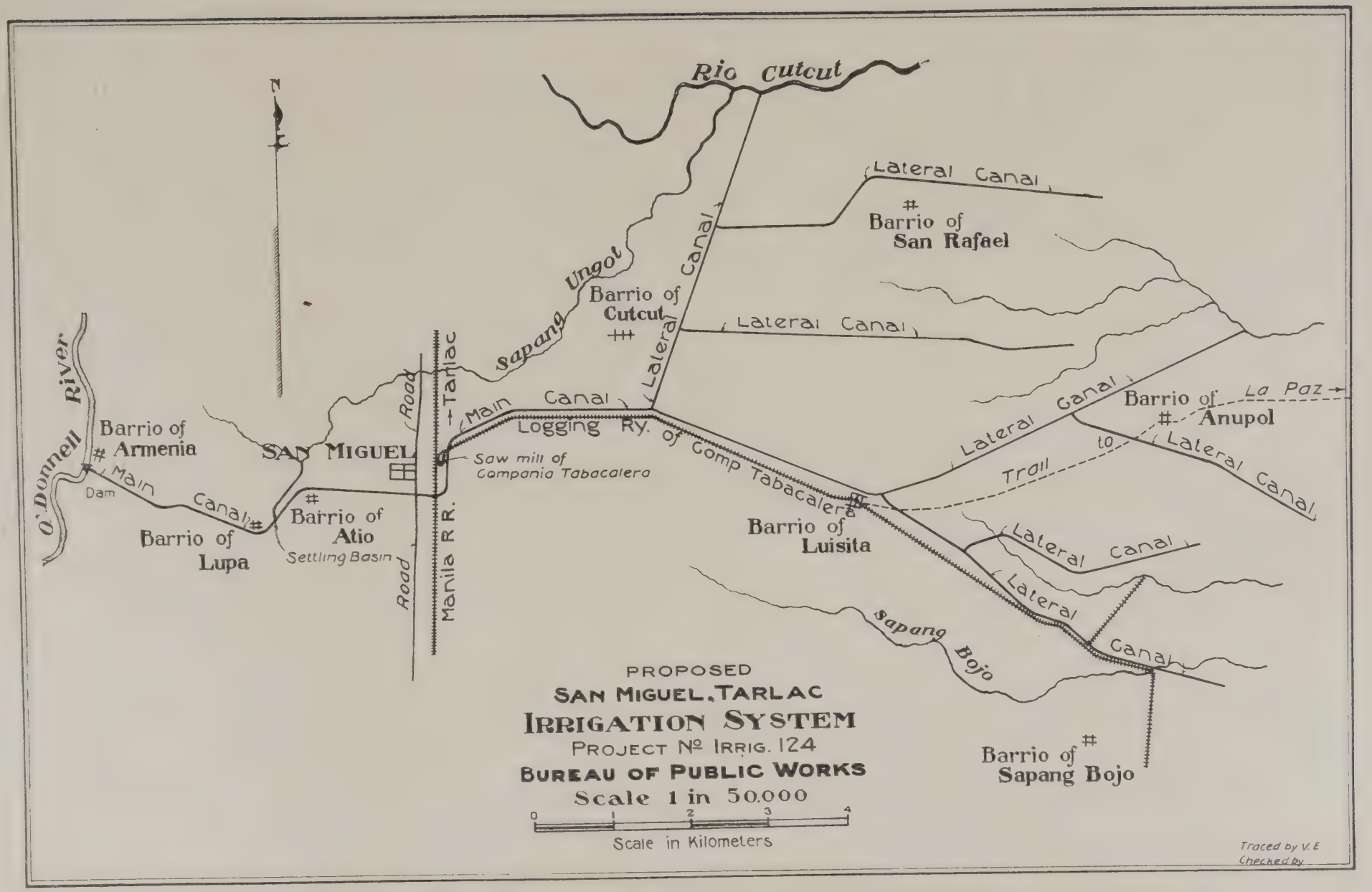
onto the concrete floor by controlling works operated from the bank above the flood level. The headgates, bays, and main canal banks will be constructed to a height above the highest flood level in order that the floods can not get into the canal and destroy it. Both above and below the dam and headwords the river banks will be protected by steel interlocking sheet piling and riprap. The falling gates will open the river bed to its natural cross section and eliminate any danger from high floods.

The water of the river, even at low stages carries a large amount of sand in suspension. To provide for this a settling basin with scouring sluices will be constructed in the main canal at a point about 2 kilometers from the headworks. The settling basin consists of a widened section of the canal with a low gradient or slope to bring the velocity of the water or the current almost to a standstill. By this means a large part of the sand carried in suspension will be deposited in the basin. At certain intervals the water will be shut off from the canal below the basin, the scouring sluices opened, and an increased velocity of the water will scour out the accumulated sand and carry it into a small creek where it can do no harm.

The larger part of the area to be served is reached by the logging railway, and it is said that this railway will be retained as a means of transportation to handle the future rice crops. In addition to this a telephone system covering the main system of canals and headworks will be installed to facilitate the operation of the project.

Irrigation operations by the Government have been limited in the past to investigations, the collection of hydrographic data, and repairs to a number of small existing systems, principally on the friar-land estates. The San Miguel project will be the first new construction of any magnitude, and will probably be followed in the near future by other larger projects. It is believed that the value to be derived from this project will not be limited entirely to the increased area of cultivated lands and the increased rice crops. As the first large modern irrigation system in the Islands, it will furnish a basis for the study of water duty, the value of the economical use of water, and the losses caused by the excessive use, or waste, of water. Permanent concrete-and-steel gates and outlets will permit the measurement of the water served to definite areas, and the information obtained should be of infinite value to the Filipino farmer.

It is also probable that the most modern agricultural methods will be adopted, and the irrigated districts will afford other agriculturists an example of up-to-date rice cultivation.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Compania Tabacalera
O'Donnell River
Barrio of
Armenia
SAN MIGUEL
Dam
Main Canal
Barrio of
Lupa
Barrio of
Atio
Settling Basin
Road
Manila R.R.
Barrio of
Luisita
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La Paz
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Sapang Bojo
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INDUSTRIAL ALCOHOL AND ITS POSSIBILITY AS A SOURCE OF POWER IN THE PHILIPPINES.[1]

By Alvin J. Cox.

Alcohol can be used as a motor fuel for all purposes for which gasoline is at present employed. Exhaustive tests made by the United States Government have demonstrated that any gasoline or kerosene engine of ordinary type can with proper manipulation operate with alcohol without material change in its construction. The engine will give slightly more power (about 10 per cent) when alcohol is used but this increase is at the expense of greater consumption of fuel. Experiments of the United States Geological Survey have shown that when denatured alcohol is employed the lowest fuel consumption is obtained with the highest practical degree of compression (11.6 to 13.7 kilograms per square centimeter), but since the vaporization temperature of alcohol is higher than that of gasoline a modified combustion chamber and carburetor is to be preferred. Some gasoline engines are not sufficiently heavy to stand the desired explosion pressure when alcohol is used and therefore a machine especially designed for alcohol is preferable to one planned to operate with gasoline or kerosene.

The United States Geological Survey made a series of over 2,000 individual tests, comparing gasoline of about 0.699 specific gravity (73° Baumé) and commercial fully denatured alcohol. Tests which corresponded in the method of manipulation showed that alcohol was more efficient than gasoline and they also proved that equal volumes of gasoline and alcohol produced the same power. This result is not usually achieved in practice. Ordinary commercial gasoline engines of stationary or marine type will consume from 1.5 to 2 times as much alcohol as gasoline when operated under the same conditions.

Alcohol is especially suited to air-cooled automobile engines, as the exhaust is not so hot as when gasoline or kerosene is used, while on the other hand the temperature of the cylinder may be hotter without danger of backfiring. The storage and use of alcohol in engines is much less dangerous than that of gasoline or petrol, and the engines operating on the former run more quietly and produce a less offensive odor. No

[1] From the Philippine Journal of Science, Vol. IV, No. 3, May, 1909.

more skill is required to operate an alcohol engine than one arranged for gasoline or kerosene.

The relative heat values of gasoline, alcohol, and coal are shown by the following approximate numbers:

	Calories.
Gasoline	11,100
Alcohol (100 per cent)	7,183
Pennsylvania anthracite	7,500

The calorific value of alcohol is of course lower by impurities, so that commercial (90 per cent) alcohol has a calorific value of about 60 per cent of that of gasoline, or a comparative heat value of over 70 per cent by volume. Alcohol of 85 per cent is the common grade of industrial alcohol used in Europe. The United States Geological Survey found difficulties in starting and regulating when the experiments employed 80 per cent alcohol and the fuel consumption increased more rapidly than the percentage of alcohol decreased.

The effect upon motors, lamps, etc., of using denatured alcohol has been discussed and deterioration has usually been attributed to the denaturant. It may be possible that all of the evils coming from the latter may be remedied in the future. Lucke and Woodward found that the interior of an alcohol engine had no tendency to become sooty, as is the case with gasoline and kerosene and there was no undue corrosion of the interior due to the use of alcohol.

The raw materials from which industrial alcohol comes consist of those substances which contain starch, sugar, and other fermentable bodies, named in the order of their importance, capable of easily being converted into a fermentable sugar. The cereals, rice, wheat, oats, rye, maize, and barley, the potato, cassava or manioc, and some other roots contain large percentages of starch. From all of these as well as from sugar cane and sugar-cane molasses, sorghum, and fruit juices which contain large percentages of sugars, alcohol is made. The artichoke which contains neither starch nor sugar but a number of other fermentable carbohydrates, of which inulin and levulin are the principal constituents, has been highly recommended and rather extensively used in Germany for the manufacture of alcohol. At the present time alcohol is made on a large commercial scale from corn, rye, potatoes, sugar beets, sugar cane, and sugar-cane molasses. Rice has the largest percentage of starch among the cereals, but it is not the cheapest source of alcohol. Indian corn, which hitherto has formed the chief raw material for fermentation and distillation, contains approximately 70 per cent of fermentable bodies, and under the best conditions a kilo of corn will usually yield about 340 grams of alcohol (420 cubic centimeters of 95 per cent alcohol by volume at 15° C.). If the average price of corn be placed at 3 centavos per kilo and the cost of manufacture, storage, profit, etc., be

PLATE III.—(*a*) NIPA FRUCTICANS, NIPA PALM OF THE PHILIPPINES.

(*b*) NATIVE DISTILLERY.

taken as an equal amount, industrial alcohol (95 per cent) from this source, untaxed, would sell wholesale for about 14 centavos a liter.

Country.	Retail price per liter in centavos.	Annual consumption (million liters).
Germany	16	140
Cuba	21	
France	23	40
England		15
United States	32	13

Beside rice, Indian corn, and sugar cane, the available sources from which alcohol can be manufactured in this Archipelago are the sap of many palms and the cassava. At present nearly all of the alcohol produced comes from the bled sap of the nipa and other palms.[1] Alcohol from the nipa has a disagreeable odor which is somewhat difficult to remove, but for industrial purposes this would be no consequence. A description of this palm (*Nipa fructicans* Wurmb.) may be found in many places. It is a species widely distributed all the way from India to Malaya, in northern Australia, and Polynesia. A very detailed study of the culture and bleeding of this palm has been published by Ayala & Co.

The nipa grows in low, salt-water tidal swamps and the plant is completely developed in about four years after planting the seed. The palms fruit about every two years, at no particular season. When the tree is ready to bleed the fruiting stem is cut as close to the young fruit as possible and the emerging liquid (*tuba*) caught in a joint of bamboo. Every day a thin slice is cut from the stem before all the tuba can be drawn.

The production of tuba from a mature tree usually increases during the first fifty to sixty days after tapping and decreases during twenty-five to thirty days more. If tuba is drawn for a longer period the tree will die. The tuba from mature stems is white, has an aromatic odor, and is sweet. That from palms having less mature fruit is bluish and less sweet and, therefore, has less fermentative value. The average yield per tree fluctuates from one-half to 3 liters per day, with a total of from 30 to 40 liters (sp. gr. 1.07 to 1.08 at 15°). The juice contains approximately 12 per cent of fermentable material which is largely saccharose. Thirty-two to 34 liters of tuba will usually produce 1 liter of pure alcohol. In the Provinces of Bulacan and Pampanga, where the price of the molasses residues from sugar cane is low, the

[1] During the fiscal year 1907–8, the figures of the Bureau of Internal Revenue show that the production from all sources was equivalent to about 4½ million liters of 95 per cent alcohol. There were practically no exports.

latter is mixed with the tuba before fermentation and is said to give a larger yield of alcohol than would the two if fermented separately.

Alcohol is removed from the fermented tuba by distillation. The method used in the provinces produces a distillate containing about 50 per cent of alcohol. By redistilling a sufficient number of times a 95 per cent alcohol might be produced, but the process would be very expensive; therefore, the crude alcohol is shipped to the large distilleries in Manila, where it can be refined more economically. In the latter, the process is continuous; the vapors pass through several stills and are cooled just sufficiently to condense them in each one until the proper purity is reached. It will, therefore, be seen that after an alcohol once passes the crude 50 per cent stage a purity of 95 per cent can be produced with very little more expense per proof liter than one of lower grade. The economy of the purer form is obvious.

The manufacture of alcohol from tuba is rather expensive and it is doubtful if the process could be greatly cheapened. Denatured alcohol (95 per cent) from this source is sold wholesale at ₱2.40, Philippine currency ($1.20, United States currency) per 15 liters, while the above estimated price for the product from corn would be ₱2.30 per 15 liters. If a market for alcohol as a fuel were opened it could undoubtedly be produced from tuba for ₱2 per 15 liters, but with the present spasmodic usage it can not be sold at that figure.

Cassava is grown in the United States over a large area of the South Atlantic and Gulf States and numerous analyses made by the division of chemistry, United States Department of Agriculture, have shown that the roots contain about 30 per cent of starch. With the exception of cereals it contains the largest amount of fermentable matter.

"An average crop of cassava in the United States may be placed at 5 tons of roots per acre on the ordinary lands of Florida, with proper preparation and cultivation a yield of from 4 to 7 or perhaps 8 tons per acre may be reasonably expected." At present there are no reliable figures on the amount that can be produced on a given area of land in the Philippines. R. F. Bacon, thinks that it is perfectly safe to figure on a production of 22½ metric tons per hectare (10 tons per acre). "With this yield," he says, "there is only one other substance which seems able to compete with it as a source of alcohol, namely, the molasses residue from the crystallization of cane sugar." E. B. Copeland estimates that when starch made from cassava sells at its present local price (15 centavos per kilo), alcohol from the same source would be worth about 17½ centavos per liter or ₱2.60 per 15 liters.

At present prices, it would be more profitable to produce starch than alcohol at a price below the latter figure. If at any time the production of cassava becomes more abundant and the utilization for other purposes less remunerative, alcohol from this source may be placed on the market very cheaply.

Some experiments with alcohol were carried out in Manila a few months ago with the 25-horsepower motor road roller purchased by the city of Manila. In all cases the machine was operated on a level road and at a standard speed. A crude alcohol such as is shipped to Manila by provincial distillers was used. The motor was first heated to a slight extent by being run for about ten minutes with gasoline; it ran for twelve minutes on the alcohol and then stopped. An examination showed that the explosions of the alcohol did not furnish enough heat to evaporate all of the water present and that a quantity had collected in the combustion chamber. When 90 and 94.5 per cent alcohol were employed the motor ran smoothly, with a consumption of 1.8 and 1.6 times, respectively, the quantity of gasoline used for the same time. Lucke and Woodward say that a small engine required 1.8 times as much alcohol (probably 85 per cent) as gasoline per horsepower hour.

The utilization of alcohol as a fuel is an established fact. The economy is the only open question. Gasoline (73°) is now sold in Manila at ₱2.38 per 15 liters (about 16 centavos per liter). On the basis of an engine consuming 1.5 times as much 95 per cent alcohol as gasoline the former would need to be sold at ₱1.60 per 15 liters in order to compete with the latter. In localities where alcohol can be produced cheaply and which are remote from gasoline supply, alcohol may immediately compete with gasoline as a power fuel, otherwise it is not probable that it will be as economical a fuel as gasoline in these Islands for some time to come and I do not anticipate an immediate change in our motor fuel.

SUGAR EXPORTS FROM ILOILO, SEPTEMBER, 1909.

[From Weekly Shipping Circular of José T. Figueras.]

Date.	Vessel.	Destination.	Superior (piculs).
September 5	Lismore	Delaware	82,000
September 18	Kaifong	Shanghai	240
		Hongkong	940
September 24	Falls of Moness	Delaware	116,800
September 24	Spithead	do	110,000
Total for September			227,980

HEMP STATISTICS, AUGUST, 1909.

EXPORTS (IN BALES).

[Far Eastern Review, September, 1909.]

Date.	Vessel.	London.	Liverpool.	Atlantic, United States.	Pacific East and California.	Continent.	Australia.	Other ports.	Total.
1909.	Forward	152,885	82,760	306,933	75,259	38,158	10,665	21,024	687,684
Aug. 1	Rubi							600	600
Aug. 1	Aldenham							30	30
Aug. 4	Numantia			19,050					19,050
Aug. 4	Taming	4,885				150			5,035
Aug. 4	Orestes		3,762						3,762
Aug. 5	Cyclops				3,150				3,150
Aug. 6	Yuengsang					40			40
Aug. 6	Indravelli			12,099					12,099
Aug. 10	Alicante	200	1,500			54			1,754
Aug. 10	Ymeric				2,999				2,999
Aug. 11	Muncastle Castle			18,125					18,125
Aug. 13	Rubi					100		665	765
Aug. 13	Erroll			2,750					2,750
Aug. 11	Kaifong Cebu	175							175
Aug. 14	Coblenz						300		300
Aug. 20	Yuengsang	1,050				100		250	1,400
Aug. 20	Muncastle Castle, Cebu			8,000					8,000
Aug. 21	Zafiro					449		350	799
Aug. 23	Politician	7,819	3,752			600			12,171
Aug. 24	Changsha						872		872
Aug. 26	Erroll, Cebu			22,300					22,300
Aug. 28	Loongsang							450	450
Aug. 28	Kumano Maru							88	88
Aug. 28	Rubi							100	100
Aug. 31	Taming	3,371				250		16	3,637
Aug. 31	Politician, Cebu	3,910	2,500						6,410
	Total for August 1909	174,120	94,449	389,257	81,408	39,901	11,837	23,573	814,545

EXPORTS FROM THE MORO PROVINCE.

Through the kindness of Mr. M. M. Saleeby, fiber specialist of the Bureau of Agriculture, we are enabled to give the following table of exports from Jolo and Davao during the past eight months.

EXPORTS FROM JOLO AND DAVAO, 1909.

JOLO.

Articles.		Units.	January.	February.	March.	April.	May.	June.	July.	August.
Hemp	Quantity	Kilos	101,220.00	75,660.00	44,592.00	86,027.00	85,476.00	[a]1,647.00	[a]750.00	144,780.00
	Value	Pesos	25,295.00	18,925.00	11,340.00	23,414.70	24,120.00	24,705.00	11,250.00	36,075.00
Hemp rope	Quantity	Kilos	1,226.00	60.00	1,410.00	10,576.00	3,359.00	3,442.00	2,272.00	1,539.00
	Value	Pesos	378.00	20.00	502.40	4,185.08	1,310.79	1,452.88	579.83	441.96
Copra	Quantity	Kilos	53,034.00	300.00	52,973.00	55,294.00	60,324.00	66,560.00	62,727.00	58,469.00
	Value	Pesos	6,943.28	150.00	7,439.85	6,330.04	8,298.64	8,574.72	8,468.46	8,637.90
Almaciga	Quantity	Kilos	29,413.00	----------	37,871.00	23,188.00	----------	3,276.00	----------	----------
	Value	Pesos	4,411.89	----------	5,070.20	3,387.14	----------	841.82	----------	----------
Pearl shells	Quantity	Kilos	9,267.00	----------	----------	----------	----------	----------	----------	----------
	Value	Pesos	5,064.01	----------	----------	----------	----------	----------	156.00	267.00
Beeswax	Quantity	Kilos	261.00	----------	136.00	----------	----------	----------	130.00	289.25
	Value	Pesos	261.00	----------	125.00	----------	----------	5,890.00	2,976.00	10,770.00
Gutta-percha	Quantity	Kilos	1,830.00	----------	3,169.00	2,997.00	----------	13,056.00	1,963.88	7,556.00
	Value	Pesos	646.25	----------	1,533.57	1,333.20	----------	2,766.00	----------	----------
Sugar	Quantity	Kilos	4,275.00	----------	5,640.00	960.00	2,362.00	193.00	----------	----------
	Value	Pesos	408.20	----------	583.68	96.00	270.20	31	----------	23
Cattle	Quantity	Numbers	5	32	22	39	43	1,280.00	----------	920.00
	Value	Pesos	200.00	1,530.00	1,100.00	1,740.00	1,720.00	502.00	258.00	90.38
Hides	Quantity	Kilos	406.00	----------	498.00	709.00	500.00	181.85	102.90	21.70
	Value	Pesos	137.20	----------	164.20	249.54	145.48	[b]8	----------	----------
Coffee	Quantity	Kilos	----------	120.00	----------	----------	218.00	----------	----------	----------
	Value	Pesos	----------	60.00	----------	----------	148.00	----------	----------	----------
Peanuts	Quantity	Kilos	----------	[b]23	----------	----------	682.00	----------	----------	----------
	Value	Pesos	----------	----------	----------	----------	194.04	----------	----------	8
Ponies	Quantity	Numbers	----------	11	8	----------	3	----------	----------	320.00
	Value	Pesos	----------	440.00	340.00	----------	145.00	----------	1,200.00	----------
Tapioca flour	Quantity	Kilos	----------	----------	----------	18	----------	----------	59.92	----------
	Value	Pesos	----------	----------	----------	540.00	----------	14	200.00	----------
Cotton	Quantity	Kilos	----------	----------	----------	----------	----------	----------	26.00	----------
	Value	Pesos	----------	----------	----------	----------	----------	1,200.00	240.00	----------
Bejuco	Quantity	Kilos	----------	----------	----------	----------	----------	240.62	16.02	----------
	Value	Pesos	----------	----------	----------	----------	----------			

Cord	Quantity	Kilos			100.00					
	Value	Pesos			20.02					
Total value		Pesos	43,744.83	21,125.00	28,218.92	41,035.70	36,352.15	50,525.89	22,597.01	54,261.80

[a] Bundles.

[b] Bags.

DAVAO.

Hemp	Quantity	Piculs	3,906.50	1,850.50	5,348.00	2,093.49	3,609.00	2,942.00	4,632.50	3,942.00
	Value	Pesos	58,587.50	25,917.50	61,467.00	22,700.15	36,668.75	29,033.00	50,266.00	44,924.00
Copra	Quantity	Piculs	136.00	111.00	141.00	151.00	210.00	82.44	156.00	237.00
	Value	Pesos	830.00	740.00	917.00	1,023.00	1,470.00	596.80	1,069.00	2,014.20
Almaciga	Quantity	Piculs	730.00	555.00	1,024.00	457.00	1,532.50	747.00	1,176.00	403.00
	Value	Pesos	5,800.00	3,885.00	7,168.00	2,892.00	10,727.00	4,855.50	7,719.00	2,418.00
Biao	Quantity	Piculs	86.50	42.00	180.00	43.00	328.00	135.00	77.00	109.00
	Value	Pesos	605.50	273.00	1,223.50	258.00	2,436.00	877.50	531.00	852.00
Hides	Quantity	Piculs	4.00	2.00			5.00	3.00	2.00	3.00
	Value	Pesos	40.00	20.00			125.00	66.00	50.00	75.00
Cotton	Quantity	Bales	1							
	Value	Pesos	80.00							
Beeswax	Quantity	Quintales			2.00		12.50	3.50		6.00
	Value	Pesos			100.00		625.00	175.00		300.00
Bejucos	Quantity	Piculs			13.00					32.00
	Value	Pesos			130.00					160.00
Shells	Quantity	Piculs					2.50			
	Value	Pesos					75.00			
Shells, pearl	Quantity	Piculs							1.00	
	Value	Pesos							40.00	
Ponies	Quantity	Numbers				9		4		
	Value	Pesos				430.00		220.00		
Cattle	Quantity	Numbers			22	5	31	77	26	10
	Value	Pesos			1,120.00	500.00	1,620.00	2,580.00	1,020.00	600.00
Total value		Pesos	65,943.00	30,835.50	72,125.50	27,803.15	53,746.75	38,403.30	60,695.00	51,343.20

According to the report of the collector of customs for the month of August, the business of the Zamboanga custom-house was the largest for any month in the history of that port since American occupation. The customs receipts for the month were ₱30,149.84, other receipts amounted to ₱197.98, making the total receipts for the month ₱30,347.82, while the import duties collected amounted to ₱28,917.64. The collector of customs at Zamboanga is of the opinion that the Payne Bill will have very little effect on the imports at Zamboanga, for the reason that the wants of the Moro people in the way of manufactured goods are peculiar and can not be supplied from the United States.

CURRENT NOTES.

PHILIPPINE SUGAR SHIPMENTS.

According to the report of Mr. José T. Figueras, general broker of Iloilo, on October 2, the sugar exports for the 1908–9 crop have been as follows: 544,400 piculs of "superior" to the United States, 50,667 piculs of "superior" and 8,915 piculs of "wet" to Japan, and 768,482 piculs of "superior" to China. The total exports for the sugar season on this date amounted to 1,363,549 piculs of "superior," and 8,915 piculs of "wet" against 1,347,728 piculs of "superior," and 40,732 piculs of "wet," of the crop for 1907–8.

With the sailing of the Standard Oil steamer *Seminole,* which loaded a cargo of 300,000 tons of sugar for San Francisco, the total of the shipment to the United States amounted to 18,725 tons or 6¼ per cent of the 300,000 tons which is allowed free entry under the provisions of the Payne bill. According to trade reports, the price of sugar is steadily advancing and the prospects for Philippine sugar growers under the free-trade provisions are very promising.

PHILIPPINE COAL.

In a bulletin published by the Bureau of Science, Mr. Warren D. Smith, chief of the mining division, in speaking of the relative merits of Australian and Batan coal gives the following tabulation from tests during two months' use of each, on the Coast Guard cutters *Busuanga* and *Negros:*

	Australian.	Batan.
Miles steamed (two months)	5,662	5,442
Tons coal consumed steaming	229	348
Total cost of coal consumed	₱3,744.15	₱2,088.00
Cost per mile steaming	₱0.66	₱0.38
Cost per 1,000 miles steaming	₱660.00	₱380.00

While it will be noted that 50 per cent more of Batan coal is required for a given run the cost is only a trifle more than one-half that for Australian coal so that when there is plenty of bunker space available a saving can be made by using Batan coal.

DAVAO HEMP PLANTERS.

According to recent reports considerable progress is being made by the Davao hemp planters. It is reported that Mr. Corwine, the Government industrial agent for the Moro Province, has taken up the matter

of official grading of the Davao product, and sample standard bales of Davao hemp have been collected and forwarded to the Plymouth Cordage Company of Massachusetts, who, it is understood, desire to take the entire output of Davao hemp. Mr. Corwine plans to classify and officially stamp all of the hemp shipped from the Moro Province in much the same way as is being done with Philippine cigars exported to the United States.

The McLane hemp machine which it is expected will arrive in the near future and the importation of labor from the neighboring Visayan islands it is believed will accomplish much to improve conditions on the hemp plantations. The 400 Visayan laborers who originally intended to go to Hawaii, it is expected, will be induced to go to Davao and other ports of Mindanao, in which case the worst problem confronting the planters will have been solved.

PRIZES FOR ILOILO TOBACCO GROWERS.

In accordance with Executive Order No. 56, dated July 9, 1909, as provided for in section 3 of Act No. 1767, the committee consisting of the provincial treasurer of Iloilo, Mr. Wilson, Mr. Merrill, of the Bureau of Agriculture, and Sr. Benito Carranceja, of the Compañía Tabacalera, appointed by the Governor-General to award the Government bounties to tobacco growers of Iloilo Province, made its awards on September 13. Apparently on account of the failure of the people to understand the rules and regulations governing the contest for these bounties, only 19 planters registered for the competition. The awards will be divided equally between the two districts, as follows:

For the production of the greatest number of marketable leaves per hectare.

First district:	
Josefa Lagdamen, Passi	₱100.00
Agapito Aujero, Passi	60.00
Felicidad Padernilla, Passi	40.00
Second district:	
Andrés Hiso, Dingle	100.00
Bernardino Simo, Dingle	60.00
Enrique Rendon, Dingle	40.00

For sorting the tobacco leaves in the most uniform manner as regards size, quality, coloring, etc.

First district:	
Agapito Aujero, Passi	₱100.00
José Lapastora, Passi	60.00
Josefa Lagdamen, Passi	40.00
Second district:	
Enrique Rendon, Dingle	100.00
Bernardino Sinoy, Dingle	60.00
Andrés Hiso, Dingle	40.00

It is believed that next year the tobacco growers will be better informed regarding the conditions of the contest and that a much larger number will compete for the bounties offered by the government.

DEPOSITS OF PHILIPPINE COPPER.

It is reported that recent development work on one of the Mancayan copper mines in Lepanto has shown the existence of ore in the lowest level of these mines and that assessment, prospecting, and some development work are being done on other claims in the vicinity. A good road with a fairly low grade is now being built from the coast at Tagudin to Cervantes; and Baguio is being connected with Cervantes by another road which will pass through the Suyoc and Mancayan districts. The construction of these two roads will be of immense advantage to miners in these districts as it will give them two outlets to the coast.

In Masbate prospecting has been carried on in the newly discovered copper district northeast of the town of Milagros. Five hundred kilograms of picked specimens of rock, which were shipped to a smelter at Tacoma, showed, besides copper, very gratifying returns in gold and silver. This deposit of native copper it is claimed was known to the Spaniards, and prospecting has been carried on more or less for a century.

OUTLET FOR CROPS FROM NUEVA VIZCAYA.

By Act No. 1961 of the Philippine Commission ₱50,000 were appropriated for the construction of a new road from Bagabag in Nueva Vizcaya to San Luis on the boundary of Isabela Province. The people of Bayombong are making every effort to have a first-class road constructed so that the Magat Valley, which they claim is one of the richest localities in the Archipelago, will be connected with the Cagayan Valley. With this outlet the Cagayan Valley will furnish a ready market for the rice, coffee, cacao, potatoes, and beans of Nueva Vizcaya, and put a stop to the importations of Saigon rice which are now supplying this large district. At present this section is so shut in by the mountains as to make the exportation of its products impossible. The only means of communication is over the Padre Juan Villaverde trail connecting at Tayug in Pangasinan with the road to Dagupan, and the pack trail connecting Bagabag with Karig in the Province of Isabela which is 65 miles long; neither of these trails furnishes an outlet for the agricultural products of the valley.

HEMP MACHINES.

The Clarke Hemp Machine which is built in Hongkong by the Philippine Hemp Machine Company, Limited, recently reached Manila and for some time has been on exhibition at Palomar Park. The machine on exhibition at Palomar has undergone several important

changes from the original machines of this company, so that it strips a full width hemp leaf without splitting or tuxying which is required by some machines. This machine will strip hemp up to 11 feet, and after stripping the fiber twists it into loose rope which makes it convenient for handling. This machine seems to be well adapted to the purpose for which it is manufactured, and judging from the trials which were witnessed by different members of this Bureau it does excellent work. The introduction of such machines will work a great change in the hemp industry not only in labor saving and in reducing the loss of fiber to a minimum but it will also produce a better grade of fiber and make the grading of Philippine hemp an easy matter which will have much to do with improving the standard and increasing the demand for Manila hemp in American and European markets.

PHILIPPINE GOLD OUTPUT.

According to the Far Eastern Review the Philippine gold output for August was as follows: the Paracale Gold Dredging Company, 623 ounces; the Benguet Consolidated, 195 ounces bullion and 254 ounces matte.

NATIVE GRAPES.

Mr. F. M. King, writing from Iloilo under date of September 19, says that there are lots of wild native grapes near Iloilo, some brown and others black, in large and well-filled bunches or clusters which when ripe are very sour. Mr. King states that he believes that these grapes could be greatly improved by grafting and cultivation so as to make a very palatable grape which will grow well in these Islands. The Director of Agriculture has requested him to forward a dozen or more cuttings of these grapes which will be grown experimentally at one of the experiment stations of this Bureau.

RESOLUTIONS OF LAGUNA AND BATANGAS REGARDING AGRICULTURAL PESTS.

More than a year ago the provincial board of Laguna in special session passed resolutions specifying the steps to be taken for stamping out the agricultural pest known as bud rot, which has killed many coconut trees in that province. In accordance with these resolutions any owner, lessee, or person having the management of coconut plantations, upon the appearance of bud rot or of any unknown disease of the coconut trees, is required to immediately report the same to the president of the municipality in which the trees are located. Each municipal president is designated as an *ex officio* inspector of the province and is immediately required to inspect such trees and require the owner, manager, or *encargado* to cut them down and destroy the disease completely by burning the top or crown of every tree cut down. Any

municipal president, owner, lessee, or manager of a coconut plantation who fails to perform his duty as above indicated is liable to a fine not exceeding ₱200 or thirty days' imprisonment. The provincial board of Laguna also passed resolutions regarding surra, glanders, rinderpest, foot-and-mouth disease, and other animal diseases which are liable to become epizootic throughout the province. These regulations are very similar to those more recently passed by the provincial board of Tayabas and printed in the April number of the REVIEW.

On August 31 last the provincial board of Batangas in an extraordinary session passed resolutions similar to those made by the provincial board of Laguna for the prevention and stamping out of animal diseases, which provided for the inspection and quarantine of diseased animals and the disposition of animals that die from contagious diseases. In this province each municipal secretary is required to keep a complete record of diseases amongst domestic animals and to send a copy of this record at the end of each month to the provincial government and the resident veterinarian in charge of the district. He is also required to keep a record of the burial, sale, and transfer of large domestic animals and to furnish a certified copy of the same to employees of the Bureau of Agriculture. These resolutions provide that anyone failing to comply with any or all of these regulations is made liable to a fine of not more than ₱200 or imprisonment for thirty days in the discretion of the justice of the peace who is given authority to try such cases.

This action on the part of the provincial boards of Laguna and Batangas is decidedly commendable and is greatly appreciated by the officials of the Bureau of Agriculture with whom rests such a large part of the responsibility for stamping out animal diseases in the provinces. At present the Bureau has veterinarians in nearly all of the provinces which have been in any way subject to such animal diseases, and it is sincerely hoped that every province in the Islands will follow the lead of Laguna, Tayabas, and Batangas and not only make regulations providing for the prevention and stamping out of dangerous animal diseases but for stamping out bud rot and other plant pests which are a great menace to the agriculture of the country.

INCREASED PRICE OF LEAF TOBACCO.

According to recent reports from Cagayan, there is a great deal of enthusiasm on the part of tobacco buyers all over the Cagayan Valley. Buyers representing all of the leading companies are now in the field, each trying to buy up the tobacco in a barrio or district before the others. In the Tawit country it is reported that a hectare of tobacco which sold last year for ₱200 brings from ₱500 to ₱600 this year. This enthusiasm on the part of tobacco buyers has aroused a great deal of interest on the

part of the farmers, who are just beginning to feel the benefits of free trade in the tobacco-growing business. Whatever effect the Payne Bill may have on the purse of the consumer in the United States, there can be no doubt but that it will become a word to conjure with in the tobacco-growing sections of the Philippine Islands. While the middlemen were the first to feel the stimulus of the open door for Philippine tobacco, it is the competition among the buyers that has brought the fruits of the bill to the tobacco farmer in the Cagayan Valley and taught him the real meaning and significance of free trade for his product in the United States.

It is believed that the Cagayan Valley is capable of producing as fine a quality of tobacco as Cuba and it now remains to be seen as to whether the Philippine tobacco grower will rise to the occasion by planting better seed, by using more modern methods of curing and fermenting his tobacco, and by more carefully grading it for the market. It is at present very evident that Philippine tobacco can not compete with Cuban tobacco and some grades which are being produced in the United States unless a great deal is done by Philippine tobacco growers along the line of improving the kinds of tobacco grown and the methods of cultivation which are now practiced in these Islands.

PHILIPPINE IRON DEPOSITS.

Very little if anything has been accomplished in the iron industry for several years. According to the Bureau of Science there are large deposits of excellent iron ore in the Provinces of Bulacan and Rizal, but at present the difficulties of transportation, the lack of coal, and the general feeling of insecurity regarding business in the Philippines have prevented capital from coming into the Islands on a sufficiently large scale for developing this industry.

The only mine which has been producing during the present year is the Hizon mine at Angat, Bulacan. This mine is operated by a Filipino, Señora María Fernández, who is the only Filipino who has shown sufficient interest to become a mine operator.

COTTON PRICES.

According to recent reports from the United States, there has been a decided advance, amounting in some sections to as much as $2 (gold) per bale in the price of cotton. The Government report of 71.9 per cent, representing a deterioration of 2.7 per cent in the crop for the month of August has had much to do with the advanced price. This means an increased price for the large amount of cotton and cotton goods consumed in the Philippines.

PHILIPPINE CEMENT MATERIALS.

In a recent article in the May number of the Philippine Journal of Science, Mr. Alvin J. Cox, in speaking of Philippine cement materials, discusses the raw cement material on the Island of Batan in the Province of Albay, and states that calculation shows that cement agreeing nicely with the theoretical analysis for Lehigh cement could be produced from materials like those taken from Batan Island, but that he is of the opinion that it will be found necessary to add silica to these materials in some shape in order to produce a wholly satisfactory cement.

In this connection Mr. Cox also discusses the raw materials found in the Mount Licos region near Danao on the Island of Cebu. He states that a large formation of schist occurs on the Island of Romblon, but this is so high in silica that it is doubtful if it could be used alone for the manufacture of cement, yet a small amount of material of this nature could doubtless be successfully employed for recomposing the ordinary clay or shale base. However, it is not improbable that highly siliceous materials similar to those in Romblon might be found on some of the smaller islands lying nearer to Cebu. It is not only the existence in this region of a superabundance of limestone and of shales that could readily be recomposed and made suitable for the manufacture of cement which attracts attention in Cebu, but the coal is at hand and the city of Cebu is an open port making transportation easy, and the cost of labor and supplies should be as low as at any other point in the Islands.

PHILIPPINE TURPENTINE.

Mr. George Richmond, writing on Philippine turpentines for the Philippine Journal of Science, states that the Benguet pine, "saleng" (*Pinus insularies* Endl.), is found distributed from Zambales Province to the extreme north end of Luzon. The Bureau of Science herbarium shows collections of this species from the Provinces of Zambales, Benguet, Ilocos Sur, Abra, Lepanto and Bontoc. The tree, in its leaf, fruit, and wood characters, shows a close resemblance to the western yellow pine (*Pinus ponderosa* Dougl.) of the United States and to the khasya pine (*Pinus khasya,* Royle) of British India.

Some Benguet pine trees were boxed and the turpentine collected by Mr. B. T. Brooks, of the chemical staff of the Bureau of Science. The sample of crude turpentine collected was submitted for examination and for an opinion as to its commercial value. It had much the appearance and consistency of crystallized honey and possessed a mild, pleasant odor. The sample of 1,961.5 grams was subjected to steam distillation as received without any previous filtering for the removal of an appreciable

quantity of foreign matter in the form of chips, bark, etc., and exhaustive distillation gave 412.2 grams (23.4 per cent) of oil of turpentine which was water-white in color.

PHILIPPINE CIGARS FOR THE UNITED STATES.

Probably the largest shipment of Philippine cigars for the United States was the one of 4,000,000 which was entered on the manifest of the Pacific Mail steamer *Siberia* when it sailed for San Francisco on September 23. The leading tobacco firms were represented, the largest of which was Castle Bros.-Wolf & Sons, who shipped 1,700,000 cigars for the American market. As a result of the free-trade law the price of cigars in the local market has increased considerably and the Alhambra, Oriente, and La Yebana factories have already advanced their prices. The product of the Alhambra factory has been increased 10 per cent and the Oriente 5 per cent, while La Yebana has made no fixed raise in price yet it has increased the price of different grades of cigars.

NATIVE LUMBER FOR EUROPE.

The Port Banga Lumber Company of Mindanao have loaded a shipment of Philippine hardwoods at their mills at Port Banga on the Norddeutscher Lloyd steamer *Tringganu* which is the first foreign vessel to load a cargo of lumber at any other point than a port of entry in the Philippine Islands, under the provisions of Act No. 1885 of the Philippine Commission.

During the past year this company has made several trial shipments to Rotterdam, Genoa, London and other points in Europe, and substantial orders are now being received. Lumber has been the principal interest of the Moro Province thus far, and with a foothold on the European market the industry promises to be greatly increased during the coming year.

PHILIPPINE MINERAL OIL COMPANIES.

During the month of August six companies were incorporated for the purpose of developing the petroleum and other mineral oil fields in Tayabas. The following companies have filed incorporation papers with the division of archives, patents, copyrights, and trade-marks of the Executive Bureau: Philippine Oil and Pipe Line Company; Tayabas Peninsula Oil and Pipe Line Company; Tayabas Mutual Oil Company; Tayabas Pioneer Oil Company; Tayabas Consolidated Oil Company, and the Tayabas Colonial Oil Company. Besides these companies several corporations have been organized for the development of Philippine coal fields.

PHILIPPINE TRADE FOR 1908.

According to the data just compiled at the Bureau of Statistics of the Department of Commerce and Labor in Washington the total value of Philippine imports for last year amounted to $29,186,120 (gold). This amount does not include the importation of $1,747,312 (gold) worth of material for railway construction which was admitted free of duty, neither does it include the export of goods for the use of the different branches of the Insular Government.

Of the $29,186,120 worth of imports, $7,138,672 was for cotton manufactures; $2,009,306 for iron and steel manufactures; $5,552,571 was for rice, $1,955,355 for meat and dairy products, $821,049 for animals, $822,335 for mineral oils, and $597,507 for coal; many of these products could, with the necessary capital for developing the natural resources of the Islands, be produced in this country.

REDUCED RATES FOR TRAVEL TO THE CARNIVAL.

According to the report of Mr. J. S. Reis, superintendent of inter-island transportation and chairman of the Carnival committee on transportation, arrangements have been made with the various inter-island steamship companies for reduced fares for out-of-town visitors to the Carnival next February. The Tabacalera Company, Inchausti & Co., Pujalte & Co., and the Bureau of Navigation have agreed to carry passengers from inter-island ports to Manila and return for one and one-third of the regular fare one way. The Compañía Marítima and Smith, Bell & Co. have agreed to make a rate for the round trip of one and one-half the regular fare one way, except from Cebu, from which port the rate charged will be the same as on the vessels of other companies. These reduced rates are only for cash fares and for freight on which the tariff is paid in advance. The above rates will be good from January 16 to March 15.

This idea on the part of the shipping companies should be encouraged and should meet with hearty response on the part of the people in all sections of the Islands. It is believed that the companies themselves could take no better step to increase their own carrying trade than this one which they have taken to help the Carnival. If the Carnival proves the real benefit to the country that is desired by the Governor-General and the leading officials of the Carnival Association it will unquestionably give a great stimulus to agriculture and trade in every part of the Islands, and in so doing it will increase the carrying trade of the railway and steamship companies. In fact, it is believed that the steamship and railroad lines would by increasing the attendance and number of exhibitors at the Carnival build up a much larger carrying trade for themselves in the immediate future by carrying Carnival exhibits from the different sections of the country free, and Carnival visitors for the regular single fare for the round trip.

EXPORTS OF PIÑA AND PEARL SHELLS TO THE UNITED STATES.

Another result of free trade with the United States is noted in the large export of piña and pearl shells. Ten thousand pesos worth of piña and over ₱5,000 worth of pearl shells and shell products were shipped to the United States during the month of August. In September a large amount of piña and pearl shells were shipped to San Francisco by the Inter-island Express Company, while the steamer *Glenlyon*, which recently sailed for New York, took ₱5,000 worth of piña and ₱3,000 worth of shells and shell products for importing houses in New York City.

PHILIPPINE FORESTS.

According to the last report of the Director of Forestry, the forest area of the Philippine Islands comprises approximately 40,000 square miles, or one-third the total area of the Islands. This area is divided into five types of forests which are classified as follows:

	Per cent.	Area.		Stand (board feet per acre).	Total stand (million board feet).
		Square miles.	Acres.		
Dipterocarp	75	30,000	19,200,000	10,000	192,000
Molave	11	4,000	2,560,000	3,000	7,680
Mountain	8	3,200	2,048,000	[a]	[a]
Pine	5	9,000	1,280,000	2,000	2,560
Mangrove	2	800	512,000	2,000	1,024
Total	100	40,000	25,600,000	----------	203,264

[a] Purely protective forests.

Besides this it is estimated that there are 20,000 square miles of second growth timber which will yield considerable quantities of small timber and firewood.

One of the most notable features of this report is the statement of the Director of Forestry regarding the cost of transportation in the Islands. The cost of transportation from the Island of Palawan to Manila, a distance of about 300 miles, is about $30 (gold) per 1,000 feet board measure, while on the other hand the freight rate from Manila to the Pacific coast amounts to about $7 (gold) per ton for logs, or about $12 or $14 (gold) per 1,000 feet board measure; and the freight rate from Manila to the Atlantic coast of the United States is about $14 or $15 (gold) per 1,000 feet board measure, or $8 (gold) per ton of 40 cubic feet.

The Director also states in this report that there is a decidedly good opportunity for one or more companies to handle mangrove products, such as lumber, poles, firewood, and tan barks. Cutch, a crude tanning product from mangrove barks, is now admitted from the Philippines into the United States free of duty. This will give any company which engages in this business in the Philippines an advantage over the cutch factories now operating in Borneo.

INDUSTRIAL EXHIBIT AT ALBAY.

One of the best moves on the part of those engaged in the work of the Bureau of Education is that which has been carried out on two or three occasions in the Bicol provinces and is again announced by Division Superintendent Caulkins, of Albay, as a feature of the Bicol meet which will be held in Albay during the first week in April, 1910. It is proposed to hold the exhibit in the provincial school building, assigning a room to each town or district. According to the plan of Superintendent Caulkins, this exhibit will contain specimens of woven work in piña, jusi, linen, pinolpog, sinamay, and other materials, also exhibits of articles woven from buri, bamboo, bejuco, abacá, nito, bakog, etc. There will be other exhibits of hats, picture frames, whips, baskets, table mats, brushes, fans, wall pockets, brooms, etc. Under the head of agriculture, there will be experiments with bamboo pots, showing that plants need light, water, air, etc., and exhibits of corn and other products raised on cultivated and uncultivated, fertilized and unfertilized land, to show the value of cultivation and fertilization, also classified specimens of soils, the best specimens of vegetables raised in a garden, and the seeds and implements used.

A NEW TOOL FOR CULTIVATING SUGAR CANE.

Señor D. Viña, of Valle Hermosa, Oriental Negros, writing to the honorable the Secretary of the Interior under date of September 5 last, speaks of a new tool for cultivating sugar cane.

About the first of June I received a cultivator for sugar cane, a rolling barrel and a 300-meter cable, which, attached to my traction engine; I have been using for cultivating my sugar plantations. This appliance is 3½ feet wide and can easily pass between the rows of cane; it has five spikes or arms with five small teeth which without any difficulty penetrate the soil from 15 to 18 inches. As it is a single machine, it needs to be drawn across the field by an animal. In order to solve this difficulty, I contemplate ordering another cultivator of this kind and when it comes I will attach a cultivator to each end of the cable so that as one comes across the field the other may go, and, in this manner, it will be possible to do about 50 or 60 per cent more work with little more expense.

The sugar plantations worked with this cultivator appear to do better than the others. Thanks to these engines, and in spite of the many difficulties which have harassed us, we have the pleasure of showing an exceptional crop, compared with that of the plantations which surround us.

NOTES FROM OTHER FIELDS.

CUBA'S TRADE FOR 1908.

According to the Bulletin of the International Union of the American Republics for July, the total imports for Cuba during the year 1908 amounted to $85,218,391, and the exports to $94,603,324, exclusive of specie. Tobacco and sugar comprised the bulk of these exports, for which the United States is the principal market. The tobacco crop for 1908 was valued at $42,321,306, which shows a slight decline as compared with the crop for 1907, the number of bales being 563,059. The leaf tobacco exports amounted to $18,354,420, the cigars to $12,275,040, cigarettes $295,883, and picadura or cut leaf to $131,576 The United States which has held the first place in the consumption of Cuban tobacco fell to second place during the year 1908, Great Britain taking first place. The countries receiving the greatest amount of the Cuban tobacco product are in order as follows: Great Britain, the United States, Germany, France, Canada, and Australia.

The total output of sugar in Cuba for the year 1908 is estimated at 1,000,000 tons. The export statistics show 593,948 tons up to March 1, 1909, indicating that the crop for the present year will probably exceed 1,400,000 tons. The average annual agricultural exports of the island are put at $38,000,000 worth of refined sugar, $12,000,000 worth of leaf tobacco, $2,000,000 worth of fruits, and $600,000 worth of vegetables. Of this export trade approximately 85 per cent goes to the United States.

REPORT OF THE SUPERINTENDENT OF ENTOMOLOGY FOR HAWAII.

The superintendent of entomology for Hawaii makes the following tabulated report of inspection work for the month of June:

	Lots.	Parcels.
Passed as free from pests	397	5,743
Ordered returned	1	15
Fumigated before releasing	17	32
Burned	3	7
Dipped in Bordeaux	1	1
Total examined	419	5,798

Among the more important pests excluded were two species of snout beetles (*Curculionidæ*), a leaf beetle (*Chrysomelid*), a click beetle (*Elaterid*), and a cockroach (*Phyllodromia hieroglyphica*) on orchids from Manila; a species of chaff scale (*Parlatoria*) from Japan, palm scale (*Aspidiotus palmæ*), mealy bugs (*Pseudococcus* sp.), whitewash scale (*Hemichonaspis* sp.), thread scale (*Ischnaspis ingirostris*), leaf miner, a leaf hopper on *Nephelium,* larvæ of a banana borer, a colony of ants, a rose-leaf caterpillar, and a long horned (*Cerambycid*) rose borer on a collection of plants from Singapore, a bean weevil (*Bruchus obtectus*) in beans from Spain, and a parasite fungus on yams from the Orient.

This report of the entomologist for Hawaii speaks for itself not only of the importance of plant inspection in Hawaii but of the importance of the inspection of plants coming into or going from any country. It would certainly seem to be high time that laws were enacted in these Islands which will prohibit the introduction of plant pests as well as the introduction of animal diseases, which would not only benefit agriculture in general by the protection of our economic and agricultural plants against the diseases of plants in other countries but it is also a protection to shippers against the loss of their products by their being—unknown to them—infected with plant diseases, as was the case with the shipment of orchids from Manila to Hawaii, above mentioned. It is believed that the problems of combating locusts, rats, animal diseases, bud rot, and other enemies of agriculture, already abroad in the Islands, are sufficiently large enough problems for our Bureaus of Health, Science, and Agriculture to combat without carelessly adding to the number of these problems by leaving our doors open to the plant diseases and pests which are abroad in foreign countries.

GROWING TREES FOR ARBOR DAY IN HAWAII.

According to Mr. Ralph S. Hosmer, superintendent of forestry for the Hawaiian Islands, arrangements have been completed whereby over 110,000 trees are being grown for free distribution to homesteaders and owners of lands throughout the territory on Arbor Day, the second Friday of November, 1909. Various substations have been established on different islands, at which trees will be grown for local distribution. The trees for the Island of Oahu will be grown at the Government nursery and at the experimental garden in Makiki; those for Kauai on the station above the Kalaheo homesteads. The stations on Maui

are at Lahaina, Wailuku, and at Makawao. On Oahu substations have been established in coöperation with interested friends of the board of agriculture and forestry.

According to the report of Mr. David Haughs, forest nurseryman for Honolulu, for the month of July, 700 forest trees were sold in transplant boxes, and 360 in pots; 3,500 forest trees in seed boxes, 350 in transplant boxes, and 150 in pots were given away.

SOME INTERESTING SUGAR DATA FROM MAURITIUS.

According to a report submitted on August 17 by the bureau of agricultural statistics and information for the Island of Mauritius, the annual rate of sugar consumption per head of population in the principal sugar-growing countries of the world is as follows:

	Kilos.		Kilos.
England	42.41	Austria	11.03
North America	36.31	Russia	9.32
Australia	45.50	Portugal	7.08
Queensland	49.90	Turkey	5.32
Denmark	33.42	Spain	5.16
Switzerland	25.05	Greece	4.61
Sweden and Norway	21.72	Bulgaria	3.62
Holland	18.78	Roumania	3.55
Germany	18.56	Italy	3.46
France	16.35	Servia	3.14
Belgium	13.47		

This same report gives the amount of sugar production in tons per square mile for 1908–9 in the principal sugar-growing centers of the world, as follows:

	Tons.		Tons.
Mauritius	277.8	Netherlands	17
Barbados	181	Germany	10
Antigua and St. Kitts	137	Fiji	8.8
Martinique	91.8	Jamaica	7.2
Hawaii	72.1	Louisiana	7.2
Porto Rico	62.6	Formosa	6
Guadalupe	56.7	France	3.8
Réunion	35	Hayti and Santo Domingo	2.6
Cuba	30	Natal	2
Trinidad	25.6	British Guiana	1.4
Java	24	Philippines	1.3
Belgium	22.4		

The average output per factory in Mauritius as compared with the output of sugar factories in the other cane-sugar producing centers of the world is given as follows:

	Tons per factory.		Tons per factory.
Spain	760	Queensland	3,490
Louisiana	1,600	Cuba	5,315
British Guiana	2,775	Porto Rico	[a] 6,419
Trinidad	2,880	Java	[b] 7,604
Mauritius	3,013	Hawaii	[c] 9,650

The sugar exports for the Island of Mauritius during the past ten years are stated as follows:

	Kilos.		Kilos.
1899–1900	157,025,400	1904–05	137,899,323
1900–01	175,267,948	1905–06	191,764,949
1901–02	147,828,478	1906–07	211,463,998
1902–03	150,349,631	1907–08	169,160,663
1903–04	218,532,152	1908–09	191,678,000

CARAVONICA COTTON IN CUBA.

Caravonica cotton is being cultivated experimentally in Cuba. Near Baracoa, in the most easterly part of Cuba, 1,500 feet above sea level, there were planted last autumn about 15 acres with "Caravonica silk," and about 50 acres with "Caravonica wool." Although the planting could not be done till the first days of December, as the seeds ordered from Australasia did not come before that time, the result is stated to be most satisfactory for both varieties; the trees have borne and are still bearing very richly. Samples of the cotton have been praised for strength, gloss, and length of staple.

[a] The ten largest factories of Porto Rico show an average of 14,480 tons, the Guanica Central has just made 43,400 tons.

[b] This figure is given from the Agricultural News (the organ of the imperial department of agriculture for the West Indies) which states in its issue of June 12 last that, according to a United States consular report, the last crop in Java amounted to 1,338,445 tons of sugar, turned out by 176 factories—thus showing an average production per factory of 7,604 tons. Since then, we have seen from the issue of July 29 of the Indian Trade Journal (organ of the commercial intelligence department of India) that, according to Mr. Ballingal, British vice-consul at Sourabaya, the sugar production of Java for the last crop amounted only to 1,217,390 tons, with 177 factories at work. This would bring the average per factory down to 6,876 tons.

[c] Short tons.

CUBAN TOBACCO EXPORTS.

Cuba's exportations from January 1 to June 30, 1909, were as follows:

Countries.	Bales.	Cigars.	Cigarettes.
United States	149,171	72,123,603	722,054
Northern Europe	635	1,086,200	1,500
France	1,209	8,463,400	37,480
Spain	1,774	4,370,281	244,837
Mexico		169,870	608,820
Other parts	119	838,550	4,328,152
Total 1909	152,908	87,151,904	5,802,843
Total 1908	116,111	78,701,912	7,101,791

THE SUGAR-CANE BORER IN CUBA.

According to E. T. Ferro, in "The Demeter," of the Louisiana State University, a sugar-cane borer attacks the white cane more than the other varieties; such varieties as the crystallina and red striped, which have a thick rind, are not frequently attacked by it. The borer always tries to get to the sweetest part of the cane, therefore very few are found in the top of the cane; most of them are found in the butts and middles where most of the sugar is accumulated. Some lands upon which cane has been cultivated for more than twenty years, without systematic rotation or resting of the land, are greatly infested with this pest. This happens to the entire Province of Matanzas, where cane alone has been grown since the land was first put under cultivation.

This pest is partially checked by the system of planting. Infected cane when cut in pieces 1 to 1½ feet long for seed will show a red stripe running through the center of the stalk, and in this way they are easily sorted without much trouble or expense.

COST OF GROWING TOBACCO IN CUBA.

The following estimate of the expense of growing tobacco in Cuba with and without shade is made as the result of an investigation by the United States consul at Havana.

The following statement is given as the cost of producing an acre of tobacco in the open:

Sun-grown tobacco.

Plowing, 20 days' wages, at $1.20	$24.00
Planting, 10 days' wages, at $1.20	12.00
Supplying, 3 days' wages, at $1.20	3.60
Hoeing (3 times), 21 days	25.20
Other cultivation expenses (estimated), such as topping, pulling off suckers, etc	15.00
Gathering crop, 15 days' wages, at $1.20	18.00
Labor in curing house (perhaps 2 days' wages)	3.00
Packing labor (unskilled), 8 bales, at $6	48.00
Total, Spanish currency	148.80
Total, American currency	129.40

The expenses of growing the crop under shade are far greater, and are placed at an average of $328.20 per acre. When shade is provided, a somewhat higher yield is usually obtained—about 10 bales per acre—and the value of the product is, of course, considerably greater. The figures which have been quoted do not represent the total cost of production. In addition to the items enumerated, the cost of supervision, depreciation of plant, implements, etc., must be taken into account. It is mentioned that the total time occupied in the production of tobacco from seed to bale is about six months. The average price realized per bale of 150 pounds of Cuba tobacco is not far from $60, and the best qualities command prices of from $70 to nearly $100 per bale. On the whole, therefore, the industry would appear to be highly profitable.

THE PREPARATION OF COPRA.

Under the present conditions, when copra reaches the European market, it has already undergone, at the place of production, a preparation which consists in cutting the fruit and letting the albumen dry by exposure to the air, the sun, or artificial heat, after which the copra is separated from the shell and shipped.

This preparation presents the serious drawback of allowing microörganisms to developed on the surface of the copra, penetrating the mass and bringing about a partial deterioration of the fatty matter. At present a large quantity of the copra when landed is covered with mold and gives out a strong rancid odor. There is thus a considerable waste, and all oil extracted has to be purified.

Mr. Dybowski, the director of the Paris colonial gardens, is of the opinion that this difficulty can be overcome. He proposes a treatment by which the surface of the copra is sterilized before shipment in such a manner as to withstand the action of microörganisms. He has been conducting experiments since 1905 with sulphurous acid, and some samples preserved since that date still show no sign of deterioration, while the product not so treated deteriorates in a few weeks. A shipment of 3,000 coconuts which was made from the Malay Archipelago last June was treated with this preparation by means of the Marot apparatus and up to the last report on July 9 there was no evidence of deterioration. Other experiments seem to prove beyond a doubt the value of this treatment which should be made known to coconut growers in general.

RUBBER FIGURES FOR 1909.

Statistics of Para grades for June, 1909.

	Quantity (tons).	Increase over 1908 (tons).	Decrease below 1908 (tons).
Para, receipts	1,570		90
Europe, shipments to	960		190
America, shipments to	920		
Liverpool:			
Imports	1,102	118	
Deliveries	1,189		238
America:			
Imports	1,620	90	
Deliveries	1,460		220
Continental:			
Imports	140		
Deliveries	270		

World's visible supply of rubber, in tons, on July 1, 1909.

	1909.		1908.	1907.	1906.
	Para.	Caucho.			
Stock in England:					
First hand	109		868	796	739
Second hand	205		356	148	187
Stock of Caucho in England		798	1,240	608	299
Stock in Para:					
First hand	50	20	180	30	
Second hand	190	10	251	170	230
Stock in America	380	410	510	570	550
Stock on Continent	10	20	250	170	560
Afloat to Europe	480	290	570	810	490
Afloat to America	100	60			
	1,524	1,608			
Total	3,132		4,634	3,602	3,445

THE SELECTION OF GROUND NUTS (ARACHIS HYPOGOEA).

The following factors, which should be taken into consideration when varieties of peanuts are being examined for seed, are printed from the Agricultural News for August 7, 1909.

(1) The suitability of the variety to the existing climatic conditions.

(2) The percentage of beans to the weight of unshelled pods. This varies considerably with different varieties.

(3) The percentage of oil to the weight of the beans from which it is extracted. This is important when the nut is being chosen for oil extraction rather than for edible purposes. A value of over 50 per cent, in this respect, indicates a valuable commercial peanut.

(4) The yield per acre, which, when considered in conjunction with the foregoing factores, determines the real value of the variety.

(5) If the uncrushed nuts are to be sold for oil extraction, the thickness of the shell is important in deciding whether the variety can be economically crushed for this purpose.

AGRICULTURAL EDUCATION IN CEYLON.

The report of the director of the royal botanic gardens, Ceylon, for 1908, states that the number of schools brought under the scheme for school gardens is 180. A special committee, which was appointed to inquire into, and report on, the work of school gardens and the subject of agricultural education generally, made recommendations to the effect that the number of school gardens be increased and the work encouraged by means of prizes; that a special course of lectures to teachers on nature study be arranged for; that a manual of nature study lessons and an agricultural reader suitable for Ceylon should be prepared; that in specially selected schools definite agricultural teaching be provided and illustrated by practical experiments; that the curriculum of teachers under training at the Government College be made to include instruction in nature study, and a special teacher to take charge of the work be appointed as soon as available; lastly, that a school of agriculture be started at Peradeniya for training agricultural instructors, and that a shorter vernacular course be provided for the benefit of candidates nominated for village headships.

A THOROUGH GERMINATION TEST FOR SEED CORN.

The best ears of seed corn should be selected to a number greater than that which will be required to provide seed for planting. From each ear six grains are chosen and placed in a germinator in the ordinary way, care being taken that each lot of six can be identified subsequently with the ear of corn from which it was removed. These are allowed to remain in the germinator until the sprouts are about $1\frac{1}{2}$ inches long. At the end of that time, every lot is examined, and, in cases where any of the six grains have failed to germinate, or where the seedlings have grown badly, the corresponding ear is rejected for sowing purposes. On the other hand, ears which have yielded lots of six grains which have successfully passed the test may be relied upon to provide good seed, and consequently good plants.

PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS, SEPTEMBER, 1909.

By the COLLECTOR OF CUSTOMS.

IMPORTS.

Articles.	Units.	Manila.	Cebu.	Iloilo.	Jolo.	Zamboanga.	Balabac.	Davao.	Totals.
Rice	Value — Dollars	353,901	107,349	84,375	1,759	9,577	59		557,020
	Quantity — Kilos	12,318,930	3,480,211	2,891,229	46,665	260,541	1,276		18,998,852
Beef cattle	Value — Dollars	10,036		11,175					21,211
	Quantity — Numbers	3,969		336					4,305
Hogs	Value — Dollars	20							20
	Quantity — Numbers	4							4
Eggs	Value — Dollars	21,717		12		23			21,752
	Quantity — Kilos	184,847		239		108			185,194
Sugar	Value — Dollars	8,791	193	895	91	236	20		10,226
	Quantity — Kilos	132,838	3,009	14,089	1,446	3,618	189		155,189
Coffee	Value — Dollars	13,639	120	1,155	265	1,163	2		16,344
	Quantity — Kilos	58,993	549	5,070	1,109	4,447	6		70,174
Cacao	Value — Dollars	12,120	2,912						15,032
	Quantity — Kilos	50,270	10,311						60,581
Raw cotton	Value — Dollars	12							12
	Quantity — Kilos	46							46

EXPORTS.

Hemp	Value — Dollars	1,166,781	443,634						1,610,415
	Quantity — Kilos	11,248,068	4,093,771						15,341,839
Sugar	Value — Dollars	5,548		938,475					944,023
	Quantity — Kilos	133,274		19,904,428					20,037,702
Copra	Value — Dollars	572,642	50,950		8,224	15,637			647,453
	Quantity — Kilos	7,890,322	663,133		111,675	222,978			8,888,108
Tobacco	Value — Dollars	55,571							55,571
	Quantity — Kilos	318,459							318,459
Cigars	Value — Dollars	196,316							196,316
	Quantity — Thousands	16,088							16,088
Cigarettes	Value — Dollars	1,824							1,824
	Quantity — Thousands	1,947							1,947

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES, SEPTEMBER, 1909.

By the DIRECTOR OF THE WEATHER BUREAU.

[Temperature and total rainfall for twenty-four hours beginning at 6 a. m. each day.]

Date.	Hemp.				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.						Aparri.		San Fernando.	
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	27.7	18.6	27.4	8.6	27.7	28.2	28.9	3.3	27.9	0	29.0	0
2	27.3	17.0	26.5	32.3	25.8	16.5	28.6	0	28.2	0	29.0	0
3	27.0	2? 4	26.5	1.3	25.6	21.3	28.4	0	28.6	0	28.6	0
4	26.2	15.7	26.4	0	26.4	0.8	28.4	0	28.4	0	29.0	14.0
5	25.3	42.4	26.6	1.0	26.3	0.8	29.1	7.1	28.4	9.4	28.8	0.6
6	26.7	11.5	27.2	0	26.1	50.8	28.4	0	27.8	0	28.0	0.5
7	26.6	1.8	28.4	0	25.0	19.8	28.0	0	27.9	0	27.8	15.7
8	26.5	5.1	28.1	0	26.6	3.6	27.8	0	28.6	0	28.5	0
9	28.0	0	28.7	0	27.3	59.4	27.6	13.1	28.7	0.3	28.4	6.6
10	28.4	0	28.7	0	26.6	1.0	27.8	2.5	27.5	21.1	56.8	7.6
11	27.8	3.8	28.6	0	26.6	16.3	27.9	0	27.0	0	28.0	5.8
12	27.6	0	28.6	0	27.1	3.3	27.6	0	27.8	9.7	27.4	6.1
13	28.6	0	28.6	0	27.1	45.5	28.6	0	27.8	0.5	28.4	0
14	28.4	4.3	28.7	0	26.7	27.1	28.4	0	28	0	28.9	0.3
15	28.1	2.0	29.1	0	27.6	0.8	28.6	0.5	28.3	0	29.1	1.5
16	25.6	11.0	26.9	24.8	27.5	5.8	25.2	13.7	26.9	0	27.8	51.3
17	26.5	28.2	26.7	3.0	25.2	47.0	24.8	116.6	25.9	30.0	24.3	81.3
18	26.1	2.0	28.3	0	26.8	23.6	25.8	53.6	26.4	4.3	24.3	76.5
19	26.5	0	28.9	0	26.7	3.3	23.9	52.9	26.8	29.0	25.5	63.2
20	27.4	1.3	28.3	0	26.5	0.8	24.0	34.1	26.6	0	24.2	96.5
21	28.4	0	28.6	22.9	26.7	0	26.6	2.5	27.2	0	25.2	0.8
22	28.2	0	28.2	0.8	27.1	0	27.8	0	28.5	0	28.3	0
23	26.6	10.1	25.5	40.7	25.5	22.6	29.1	1.0	28.2	0	28.2	0
24	26.9	4.1	26.5	0	26.0	1.0	28.8	16.0	28.5	0	28.3	0
25	26.8	0	27.9	3.8	25.1	68.1	27.8	0	27.8	0	28.4	0.5
26	27.8	1.3	26.6	0.8	25.4	4.5	28.6	0	28.5	0	28.2	3.8
27	27.5	0	27.0	0	26.5	0.8	29.0	0	27.4	52.6	27.5	0
28	27.2	9.9	26.9	0	25.8	0.5	28.4	0	26.1	0.5	27.6	0
29	27.4	6.6	26.4	5.6	26.0	10.1	28.4	0	27.5	3.6	27.4	0
30	27.8	5.3	25.7	1.3	25.2	10.9	29.2	12.4	27.8	0	28.0	0

RANGE OF PRICES OF PHILIPPINE AGRICULTURAL PRODUCTS.

Highest and lowest prices of rice, abaca, copra, sugar, tobacco, and corn for the month of August, 1909.

NOTE.—75 liters=1 cavan; 63.25 kilos=1 picul; 46 kilos=1 quintal.

Province.	Unhulled rice, per 75 liters.		Abaca, per 63.25 kilos.		Copra, per 63.25 kilos.		Sugar, per 63.25 kilos.		Tobacco, per 46 kilos.		Corn, per 75 liters.		General condition of crops.
	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	Highest.	Lowest.	
Agusan	₱3.00	₱3.00	₱7.90	₱7.00	₱8.20	₱8.20					₱2.50	₱2.00	Good.
Albay	3.00	2.00	10.00	7.25	8.00	6.25					5.00	2.50	Fair.
Ambos Camarines	3.75	2.50	12.00	7.00	8.50	4.75	₱4.00	₱2.20	₱6.00	₱6.00	4.00	2.00	Good.
Antique	3.12	1.75	18.00	18.00	6.00	6.00	4.50	3.00	15.00	12.00	2.50	1.00	Do.
Bataan	3.00	1.75					7.00	5.00			3.50	1.50	Fair.
Batangas	4.00	2.50	11.50	5.00			4.50	3.00	8.00	6.00	3.50	1.80	Do.
Bohol	4.00	3.00	12.00	7.59	9.00	6.00	10.00	3.00	20.00	11.00	4.50	2.00	Do.
Bulacan	2.85	2.50					7.20	7.00	20.00	10.00	2.54	1.50	Do.
Cagayan	4.50	3.00							13.00	7.00	5.00	2.25	Do.
Capiz	3.75	2.00	14.00	8.00	8.00	5.50	6.00	3.50	10.00	4.00	3.75	1.00	Do.
Cavite	3.25	2.50	10.00	10.00			3.25	3.25			2.50	2.50	Do.
Cebu	4.50	2.50	14.00	8.00	10.00	6.00	8.00	3.00	20.00	4.50	4.50	2.50	Good.
Ilocos Norte	5.00	3.00							11.25	4.00	3.50	1.00	Fair.
Ilocos Sur	3.75	3.12			10.00	10.00	7.00	2.25	25.00	2.30	5.00	2.00	Do.
Iloilo	3.50	2.50	18.00	18.00	10.00	6.50	8.00	5.50	19.00	3.50	4.50	2.50	Do.
Isabela									15.00	15.00			Do.
La Laguna	3.20	2.00	7.00	6.00	8.00	6.25	5.00	5.00			3.00	2.00	Do.
La Union	3.50	3.00			7.00	7.00	5.00	2.50	9.00	4.87	4.75	2.00	Do.
Leyte	3.50	2.50	12.50	8.75	8.50	6.00	5.50	4.50	20.00	15.00	5.00	2.00	Good.
Mindoro	3.00	3.00	10.00	10.00	5.00	5.00					2.50	2.50	Do.
Misamis	3.75	3.00	8.22	7.50	9.59	7.50	4.00	4.00			3.75	3.00	Do.
Moro Province	3.50	2.50	10.00	8.20	9.00	7.50	5.75	5.00			2.50	2.00	Fair.
Mountain Province	5.00	3.00					6.00	4.00	6.00	6.00	5.00	2.50	Do.
Nueva Ecija	2.35	1.25					7.50	4.00	15.00	10.00	2.00	1.20	Good.
Nueva Viscaya	2.50	2.50											Do.
Occidental Negros	3.12	3.00	11.00	9.00	10.50	6.50	7.00	5.50	6.50	6.50	3.00	2.00	Fair.
Oriental Negros	3.75	3.50	10.00	6.00	9.80	7.00	5.50	5.00	7.00	7.00	5.00	4.00	Good.
Palawan	4.00	3.00			5.00	5.00					2.00	2.00	Fair.
Pampanga	2.50	2.40					6.50	6.00			2.50	2.25	Good.
Pangasinan	3.25	2.00			8.00	4.50	8.00	3.00	16.00	4.50	4.00	1.50	Fair.
Rizal	3.00	2.00	18.00	18.00			8.00	7.00			2.50	2.00	Do.
Samar	3.75	2.00	12.00	6.00	7.75	5.50			13.00	5.00	3.12	2.00	Good.
Sorsogon	3.90	2.50	12.00	9.00	8.50	4.50	7.00	3.50	3.90	3.90	3.00	2.00	Fair.
Surigao	2.50	1.75	11.50	9.00	8.62	7.00					1.75	1.75	Do.
Tarlac	3.00	2.00					8.00	4.00	10.00	3.00	4.25	1.50	Do.
Tayabas	3.37	2.50	12.00	6.00	7.00	4.50			7.00	6.00	3.00	2.00	Good.
Zambales	2.75	1.75			5.00	5.00	5.00	2.00	12.50	12.50	3.00	2.00	Fair.

PERIODICALS IN THE LIBRARY OF THE BUREAU OF AGRICULTURE.

Everyone interested in the study of tropical agriculture is invited to visit the library and make use of these periodicals.

ENGLISH.

GENERAL.

Agricultural Bulletin of the Straits and Federated Malay States, Singapore.
The Queensland Agricultural Journal, Brisbane, Australia.
The Agricultural Gazette, Sydney, New South Wales.
Journal of the Department of Agriculture of Victoria, Melbourne, Australia.
Journal of the Department of Agriculture of Western Australia, Perth.
Journal of the College of Agriculture, Tokyo, Japan.
Hawaiian Forester and Agriculturist, Honolulu, Territory of Hawaii.
Tropical Agriculturist, Colombo, Ceylon.
The Agricultural Journal of India, Calcutta.
Memoirs of the Department of Agriculture, Calcutta, India.
Natal Agricultural Journal, Pietermaritzburg, Natal, South Africa.
Agricultural News, Bridgetown, Barbados.
West Indian Bulletin, Bridgetown, Barbados.
The West Indian Committee Circular, London.
The Cuba Review, New York.
Bulletin of the Department of Agriculture, Kingston, Jamaica.
Journal of the Jamaica Agricultural Society, Kingston.
Bulletin of Agricultural Information, Trinidad.
Journal of the Board of Agriculture of British Guiana, Georgetown.
California Cultivator, Los Angeles, California.
The Rural Californian, Los Angeles, California.
Farmer and Fruit Grower, Jacksonville, Florida.
Louisiana Planter, New Orleans, Louisiana.
Southern Cultivator, Atlanta, Georgia.
Progressive Farmer, Raleigh, North Carolina.
Farmer's Guide, Huntington, Indiana.
Kansas Farmer, Topeka, Kansas.
Farm Press, Chicago, Illinois.
The American Florist, Chicago and New York.
The Feather, Washington, D. C.
The American Thresherman, Madison, Wisconsin.
Oregon Agriculturist, Portland, Oregon.
Journal of Agriculture and Horticulture, Montreal, Canada.
The Gardeners' Chronicle, London.
Commercial America, Philadelphia, Pennsylvania.
Tropical Life, London, England.
Horn and Hoof, Seattle, Washington.
The Breeders' Gazette, Chicago, Illinois.
The Journal of Tropical Veterinary Science, Calcutta, India.
American Veterinary Review, New York.

REPORTS AND QUOTATIONS.

Crop Reporter, by the Secretary of Agriculture, Washington, D. C.
Monthly Consular and Trade Reports, Washington, D. C.
Federal Reporter, New York, N. Y.
Smith and Schipper's Monthly Report, New York, N. Y.
Hanson and Orth, Hemp Brokers, Monthly Statement, New York.
Hemp Market Report, Landauer & Co., London.
Ide and Christie's Monthly Circular, London.
Exporters and Importers Journal, Chicago, Illinois.
Quarterly Summary of Commerce of the Philippine Islands, Washington, D. C.
Ker & Co's. Price Current, Manila, Iloilo, and Cebu, P. I.
Weekly Shipping Circular (Sugar), Jose T. Figueras, Iloilo, P. I.

LOCAL.

Official Gazette, Manila, P. I.
Far Eastern Review, Manila, P. I.
Philippine Journal of Science, Manila, P. I.
Weather Bureau Bulletins, Manila, P. I.
The Philippine Agricultural Review, Manila, P. I.

SPANISH.

Boletin de la Cámara de Comercio Filipina, Manila, P. I.
Boletin Oficial de la Secretaría de Agricultura, Comercio y Trabajo, Cuba.
Boletin de Agricultura, San José, Costa Rica.
Hacendado Mexicano, El, Mexico, Mexico.
Hacienda, La, Buffalo, New York.
Industrias Americanas, New York, N. Y.
Revista del Ministerio de Obras Públicas, Bogotá, Colombia.
Agricultor Peruano, El, Lima, Peru.
Revista de la Asociación Rural del Uruguay, Montevideo.
Prácticas Modernas é Industrias Rurales, La Coruña, Spain.
Resumen de Agricultura, Barcelona, Spain.

OTHER LANGUAGES.

Bulletin de la Chambre de Commerce de Saigon, Saigon, Indo-China.
Bulletin Economique, Hanoi-Haiphong, Indo-China.
Chamber d'Agriculture du Tonkin, Hanoi-Haiphong.
Bulletin de Department de l'Agriculture aux Indes Neerlandaises, Java.
L'Agronomie Tropicale, Brussels, Belgium.
Boletim de Agricultura, Sao Paolo, Brazil.
Tamil Journal of South India Agriculture, Madras, India.
Station Agronomique, Port Louis, Colony of Mauritius.
Journal d'Agriculture Tropicale, Paris.
Boletim do Museu Goeldi, Para, Brazil.
O Fazendeiro, Sao Paolo, Brazúl.
Boletim da Sociedade de Geographia de Lisboa, Portugal.

THE PUBLICATIONS OF THE BUREAU OF AGRICULTURE.

The following-named bulletins of the Bureau of Agriculture are available for distribution, and will be sent free of charge to any address upon application. Applicants are requested to state whether all publications of the Bureau are desired as issued, or only those specified. The name and address of the applicant should be plainly written and all communications should be addressed to the Director of Agriculture, Manila, Philippine Islands.

FARMERS' BULLETINS.

No. 4. Preliminary Report on Commercial Fibers of the Philippines. (Spanish.)
No. 6. Experimental Work with Fungous Diseases of Grasshoppers. (Spanish.)
No. 9. A few Suggestions on the Cultivation of Cotton. (Spanish.)
No. 11. The Jute Industry. (Spanish.)
No. 12. Abacá. (Manila Hemp.) (English.)
No. 13. The Cultivation of Maguey in the Philippine Islands. (English and Spanish.)
No. 14. The Cultivation of Sesamum in the Philippine Islands. (Spanish.)
No. 15. Tobacco Growing in the Philippines. (English and Spanish.)

PRESS BULLETINS.

No. 6. The Tamarind. (English.)
No. 8. Maguey; Propagating Abacá from Seed; etc. (English.)
No. 9. Agricultural Districts; Control of Rinderpest; etc. (English.)
No. 11. Seed Distribution; Need of Diversified Farming; etc. (English and Spanish.)

POPULAR BULLETINS.

No. 1. Maguey. (English, Spanish, Visayan, Cebuano.)
No. 2. Kapok. (English, Spanish, Tagalog, Visayan, Ilocano, Cebuano.)

PLATE I.— MIRADOR OBSERVATORY, BAGUIO, BENGUET.

One of the greatest safeguards to the people of the Philippines and their property—homes, farms, and crops—is the efficient services rendered by the stations of the Weather Bureau. By increasing their efficiency the Government gives greater security to life and encourages the development of the country.

THE PHILIPPINE

Agricultural Review

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EDITORIAL.

ROUNDING OUT THE SECOND YEAR.

With this number the PHILIPPINE AGRICULTURAL REVIEW completes its second year as a monthly periodical. It is believed that the Spanish and English editions of the REVIEW, with a mailing list that totals nearly 8,000 readers, enjoy the largest circulation of any periodical published in the Philippines. In addition to the circulation in the Islands, the REVIEW has a large circulation in the United States, Hawaii, Japan, China, Indo-China, British North Borneo, the Straits Settlements, the Federated Malay States, Netherlands-India, Ceylon, India, Africa, Brazil, the Guianas, Colombia, Peru, Costa Rica, the West Indies, including Cuba, Porto Rico and Jamaica, and Mexico. In Europe it reaches the principal libraries and agricultural institutions in Spain, France, Italy, Switzerland, Holland, Germany, Russia, Norway, Sweden, Denmark, and Great Britain. The list of exchanges which appears on the last pages of this number, it is believed, constitutes the largest collection of periodicals on tropical and subtropical agriculture that is available in any one library in the Orient.

The object of the REVIEW, as stated by the Director of Agriculture in the first number, is to interest first of all the Filipino people in the subject of tropical agriculture, and secondly, to coöperate and discuss with the farmers of the Philippines the more prominent and pertinent questions of tropical agriculture, in which the agriculturists of the Philippines are interested in common with the people of Formosa, Hawaii, Indo-China, the Federated Malay States, Netherlands-India, Ceylon, southern India, and northern Australia, which countries constitute the field of tropical agriculture in the Far East.

During the coming year the REVIEW hopes to get more fully in touch with the individual farmers of the Philippines and the aim will be to make its pages as interesting as possible to provincial readers. To this end the coöperation of everyone who reads the English or Spanish edition of the REVIEW is asked, that the calendar year 1910 may be made a banner year, not only in the interest in but also in the study of scientific agriculture and the actual development of the agricultural resources of these Islands.

THE NATIVE PRESS AND PHILIPPINE PROGRESS.

There are in these Islands 30 or 40 papers and periodicals published in Spanish and the various dialects of the provinces; in addition to these there are about 20 other publications in Spanish and Tagalog published in the city of Manila. But few of these publications give any attention to agriculture, good roads, or the trades and occupations of their respective localities in which the people are engaged. The substance of

most of these publications consists of advertisements, matters of a personal nature, the doings of the Government, and a large amount of space devoted to the discussion of politics or political candidates. This sort of material does little toward putting the country on a better financial or independent business basis.

One of the greatest obstacles in the way of independence for the Philippines is the lack of trade and commerce to put the country on a satisfactory financial foundation. The productions of the Philippines as compared with either Java or Japan are so small that they do not in any way approach the category or the standard which is necessary for an independent country or nation. We do not desire to discourage the native press in any educational work which it is now doing, but we would suggest that it devote more attention to those subjects which help agriculturists, manufacturers, or workers in any native art or trade to increase the quantity and better the quality of the output of the particular line of business in which they are engaged. It seems to us that the editors and directors of the native press are making little or no effort to help the actual producers to improve the industrial and financial condition of their respective communities.

In practically every town in the provinces there is held one or two market days each week. On these days the people gather from all parts of the town, and often those engaged in trade come long distances from other towns to sell their products and to visit with friends from other towns or distant barrios. We see no reason why these market days, which are one of the most important social and commercial features of life in the country, should not be made a sort of village fair, as in some other parts of the Orient. We believe it would be a very easy matter for the officials of each municipality to interest the people in raising better and more agricultural products and improving their trades by offering small prizes for the best products of the agriculture and the trades in each town. By offering prizes for the best products the officials of each municipality would stimulate a general interest on the part of the people so that they would make an effort to raise better rice, corn, camotes, gabi, and other vegetables and to improve their trades. A general inquiry on the part of the people as to *how* to raise better products, *how* to obtain better yields, and *how* to improve their trades would begin at once. By offering prizes for the best fowls exhibited for sale the poultry-growing business could be greatly stimulated. Egg-laying contests might be organized and prizes offered for the largest number of eggs laid during a fixed period, and thus largely increase the egg-producing capacity of Philippine poultry.

In this manner municipal governments could greatly stimulate all occupations, trades, and the lines of work in which every individual, whether he is the owner of lands or a laborer in the fields or factories,

is interested. As already stated, we see no reason why the weekly market day in every town in the Philippines should not be made to stimulate the development of the native industries of the country.

The editors of the REVIEW will be glad to furnish matter along the lines above mentioned on application from any editor of a native paper in Manila or the provinces.

A FARMERS' QUESTION PAGE.

At this time it is desired to call attention to the opportunity which the editors, in the July number of the REVIEW, offered to farmers for the general discussion of the best methods of growing the staple crops of the country, that those who are experimenting along certain agricultural lines may give other farmers in different parts of the country the benefit of their experience. We wish to again call the attention of our readers to the advantages of such a department which in other countries has been a great help not only to those who have taken advantage of it but to farmers in general. Through such a department of the REVIEW we would have the hemp growers of Davao give the results of their experience for the benefit of the hemp growers of Camarines, Albay, Sorsogon, and other hemp sections; we would have the sugar growers of Negros give those who are growing sugar cane in Bulacan, Pampanga, and Pangasinan the benefit of their experience by answering questions on sugar growing under the above heading. In this way the REVIEW might be the means of greater coöperation between the farmers in different parts of the Islands, and those engaged in all lines of agricultural work might profit by the experience of others in different sections.

As to whether or not we shall have such a department in the REVIEW is for our readers to decide. It is hoped that the leading producers of the staple agricultural crops from all parts of the Islands will attend the agricultural conferences at the Carnival, at which time the importance of coöperation on the part of everyone interested in agriculture—of asking questions and having them answered—will be strongly emphasized.

THE LIVE-STOCK INDUSTRY OF THE PHILIPPINES.

In this number of the REVIEW we are presenting two articles which bear directly on the live-stock industry in the Philippine Islands. The first is "The Production of Serum, its Use and Effect," by Dr. C. G. Thomson, veterinarian in charge of the serum laboratory at the Alabang stock farm, and the second "The Cattle of Southern India," by Lieut. Col. W. D. Gunn, superintendent of the Indian civil veterinary department for the Presidency of Madras.

The article by Doctor Thomson on the production of serum, its use and effects, is one of the best that the REVIEW has been able to present

on the subject of combating animal diseases in these Islands and everyone who is an owner of cattle or in any way interested in the livestock industry should read this article, as it not only gives a concise statement of the character of the disease known as rinderpest but a most careful and complete statement of the most practical and up-to-date methods of combating it.

The question of a suitable draft animal for the average Philippine farmer is one which the animal industry division of this Bureau and the leading farmers of the Islands have endeavored to solve for many years. At present the most likely solution of this problem seems to be the introduction of cattle from India. The best Indian breeds have been exported to Java, Brazil, the West Indies and other countries where they have been very successfully used for draft animals. There seem to be many reasons for believing that these animals will readily adapt themselves to the climate and other conditions existing in the Philippines. The careful discussion by Lieutenant-Colonel Gunn of the stock-raising industry in India, the characteristics of the principal breeds, the leading cattle districts and the cattle shows should be intensely interesting to everyone concerned with the solution of this problem in the Philippines.

AN AGRICULTURAL ASSOCIATION FOR PAMPANGA.

BACOLOR, PAMPANGA, P. I., *November 7, 1909.*

To the farmers of Pampanga:

The undersigned has the honor to request you to be present at a mass meeting of farmers which will be held in the upstairs office of the editor of "El Pueblo," or in whatever place designated, in the town of Bacolor, Pampanga, at 9 a. m. on Saturday, November 20.

The object of this meeting is to determine the best and most convenient manner of organizing a farmers' association in our province similar to that organized in Occidental Negros and other provinces of the Visayas.

In addressing you we hope that you will not fail to understand the patriotic and altruistic motives of this meeting, and that the time has come when Philippine agriculture must take on new life and that this work must be done not only by the Government but by *the farmers themselves and the latter can not do their part without organization.*

For the reasons above stated it is hoped that you will not fail to attend this meeting.

Respectfully,

F. LIONGSON,
For the Permanent Committee.

The REVIEW is glad to record the calling of the above meeting of the farmers of Pampanga. We would like to see the agriculturists of Bulacan, Nueva Ecija, Pangasinan, Isabela, Cagayan, and Laguna, and in fact all of the agricultural provinces in the Philippines, call like meetings of the farmers and those interested in obtaining the best crops and the largest yields of the crops which are being grown in the different sections of the country for the organization of farmer's associations with the purpose of coöperating and securing the enactment of laws for the development of agriculture and for the protection of the best interests of the farmers in the different sections of the country. It is certainly high time that such associations were organized in all of the agricultural provinces of the Islands.

It is suggested that in every province where it is possible the farmers be called together and select official representatives to attend the Carnival and speak for their respective provinces at the exhibit and conferences which will be held during the Carnival. By meeting together and discussing their local conditions the agricultural representatives of each province will be able to state more definitely and with greater certainty the conditions and needs for the agricultural development of their respective districts. By such organization and representation those who

have charge of this part of the Carnival as well as the farmers themselves, will be enabled to obtain much more satisfactory results than from scattered delegations and representatives from the different provinces. It will be much easier for the Bureau of Agriculture to determine the exact conditions and the actual needs of the different sections of the country from such a delegation or group of representatives than from a single farmer from any one section or province.

According to the "Implement Age," of June, 1909, there are 979, nearly 1,000, State and county fairs held in the different States and Territories of the United States. The State of Rhode Island which is smaller than the Province of Antique holds 2 fairs; New Jersey which is smaller than Davao holds 3; Kentucky, which is smaller than the Island of Luzon, holds 34; Indiana holds 60; Ohio, 76; Iowa, 89; and New York, which has the largest number held in any one State, has 90. If any satisfactory progress is to be made in the development of agriculture in the Philippines it must be clear, as stated by Sr. Liongson, of Bacolor, that the farmers themselves must organize and do some active and energetic work. The Government can encourage and help those who are interested in agriculture but the real work and actual results can be accomplished only by the farmers themselves.

MIRADOR OBSERVATORY, BAGUIO, BENGUET.[1]

By Rev. Jose Algue S. J., *Director of the Weather Bureau.*

LOCATION OF THE STATION.

Site.—The property on which the new station has been established lies within the town site of Baguio, Benguet, close to the western boundary thereof, and comprises an isolated hill, "Mirador" (Mount Lookout), so called on account of the magnificent view which may be enjoyed from its summit. This hill terminates the famous Baguio Plateau on the western side. Its top is a level, nearly elliptical, surface, the major axis of which lies NW.–SE and measures 132 meters (433 feet), while the minor axis is only 52 meters (171 feet). The mean level of this miniature plateau is 1,511.75 meters (4,969.9 feet) above mean sea level.

As the mean elevation of the Baguio Platean is 1,444.8 meters (4,740 feet), Mirador rises more than 66 meters (216.5 feet) above the latter and is very conspicuous from every part of the valley. The road to San Fernando, Union, passes at a short distance to the north of Mirador, skirting the limestone hills at an average level of 1,453.9 meters (4,770 feet) above the sea. Toward the west a valley, the bottom of whose upper end lies about 152.4 meters (500 feet) below the top of Mount Mirador, stretches from the foot of this hill as far as the coast. Hence the China Sea can be seen on clear days from the top of Mirador to a distance of 119 kilometers (74 miles); that is to say, 77 kilometers (58 miles) beyond the mouth of the Aringay River, which is the nearest point of the coast of Union Province. In this direction the view is limited only by the horizon on the China Sea; the Gulf of Lingayen, the Bolinao Peninsula, and the China Sea beyond are easily made out, as are also many miles of the coast line of Pangasinan to the north, and of Union to the south. Toward the SSW., at a distance of 7.24 kilometers (4.5 miles), Mount Santo Tomas with its three peaks stands out prominently, the highest of which reaches 2,232.6 meters (7,425 feet) above sea level.

Building.—In the center of the elliptical plateau forming the summit of Mount Mirador rises a substantial stone building, 56 meters (183.6

[1] Extracts from "Mirador Observatory, Baguio, Benguet. A new Meteorological-Geodynamic station of the Weather Bureau."

feet) long in the direction of the major axis of the plateau and 14 meters (35 feet) wide in its central part. The latter is in reality flanked by four towers, two at each end, but as each pair of these has a continuous roof, they appear as two cross-wings of 20 meters (65.6 feet) length and 6 meters (19.7 feet) width, giving to the whole structure the form of the letter "I." These towers have a height of 10.7 meters (35 feet) from the ground to the ridge of the roof, while the height of the main building, measured in the same way, is 9.1 meters (30 feet).

The construction was begun in November, 1907, and was sufficiently advanced in the beginning of January, 1909, to allow of the installation of some instruments. In September, 1909, the work was finished. A wagon road has been constructed from the San Fernando road to the top of the hill. The building serves a twofold purpose; as a sanatorium for the Mission of the Jesuits in the Philippines, and to house a branch station of the Manila Observatory for meteorological and geodynamic observations.

The approximate position of Mirador Observatory is latitude, 16° 25′ N; longitude, 120° 36′ E; elevation, 1,511.75 meters.

In the catalogue of all the meteorological stations in the world, published by the Smithsonian Institution of Washington, D. C., it will be seen that Mirador is one of the 43 highest meteorological stations in the world which are located as follows: Sulphur Mountain in Canada; Pike's Peak, Santa Fe, Cheyenne, Lander, and Denver in the United States; Zacatecas, Tacubaya, Mexico, Puebla, Guanajato, San Luis Potosi, Leon, and Saltillo in Mexico: El Misti and Arequipa in Peru; Potosi in Bolivia; Quito in Ecuador; Bogota in Colombia; Somnblick, Obir (Hannwarte), Obir (Berghaus and Schmittenhohe) in Austria; Wendelstein in Bavaria; Santis, St. Bernard, Pilatus-Kulm, and Sils-Maria in Switzerland; Mont Blanc (Grand Mulets) and Mont Blanc (Les Bosses) in France; Schneekoppe in Prussia; Gudaur and Kars in Russia; Leh-Kashmir, Kodaikanal, Darjeeling, Simla, Murree, Ranikhet, Wellington, and Quetta in India, and Newera Eliya in Ceylon.

Fourteen of these stations are within the tropics. East of India, or east of the 82° E. meridian, Mirador would be by far the highest meteorological station, were it not for the fact that a few months ago the Japanese Government established one on Mount Fuji. The exact elevation of this station could not be ascertained, but to judge from the uncorrected barometer readings, it would appear to be approximately 3,550 meters (11,647 feet), which would place it 228 meters (748 feet) below the summit of the snow-capped volcano. Tsukuba, formerly the highest station in Japan, has an altitude of only 870 meters (2,854 feet); and the highest station in Australia, Alice Springs, South Australia, of 587 meters (1,926 feet).

SUMMARY REPORT ON CLIMATIC CONDITIONS.

At the request of the United States Philippine Commission a meteorological station was established at Baguio as early as August, 1900, which, shortly after the creation of the Weather Bureau in May, 1901, was incorporated into this Bureau as one of its 8 first-class stations, and equipped with better and more numerous instruments. In 1903 economic reasons made its reduction to a third-class station necessary, and as such it existed until July 1, 1909, when the new observatory was inaugurated.

The data gathered during the period September 1, 1900, to August 31, 1901, have been published during March, 1902, in a pamphlet entitled "The Climate of Baguio, Benguet" (76 pages and 34 plates), which forms Part I of the Annual Report of the Director of the Weather Bureau for 1901–2. Covering only one year, this report could give only a very imperfect idea of the *average* climatic conditions of the Baguio Plateau. Further data have since then been published in the Monthly Bulletin and Annual Reports of the Weather Bureau, from which a sufficiently accurate knowledge may be had of the climate of the "Simla of the Philippines."

Mean and extreme temperature at Baguio and Simla.

FAHRENHEIT.

	Mean maximum.		Mean minimum.		Monthly mean.		Absolute maximum.			Absolute minimum.		
	°F.	°F.	°F.	°F.	°F.	°F.	°F.	Year.	°F.	°F.	Year.	°F.
January:												
Baguio	74.7	24.1	47.4	7.4	62.4	19.8	77.0	1906	16.2	37.4	1907	19.2
Simla	50.6		40.0		42.6		60.8	1906		18.2	1905	
February:												
Baguio	75.3	22.8	45.6	5.2	61.7	20.7	80.6	1906	16.1	42.8	1902	24.3
Simla	52.5		40.4		41.0		64.5	1903		18.5	1906, 1905	
March:												
Baguio	77.7	21.3	49.5	3.5	66.3	15.8	81.0	1906	12.4	46.8	1907	25.9
Simla	56.4		46.0		50.5		68.6	1908		20.9	1907	
April:												
Baguio	77.5	12.5	52.6	0.4	66.3	11.5	84.7	1902	10.1	48.2	1902	17.9
Simla	65.0		52.2		54.8		74.6	1908		30.3	1905	
May:												
Baguio	77.9	4.8	54.5	—4.1	66.4	0.5	82.4	1902	0.8	51.8	1907	7.3
Simla	73.1		58.6		65.9		81.6	1906		44.5	1908	
June:												
Baguio	76.9	4.4	57.4	—2.2	66.3	—1.5	79.5	1902	—4.2	55.4	1902	6.3
Simla	72.5		59.6		67.8		83.7	1901		49.1	1907	
July:												
Baguio	75.9	6.7	56.2	—3.9	65.6	0.7	79.7	1902	—4.7	53.8	1906	0.7
Simla	69.2		60.1		64.9		84.4	1901		53.1	1907	
August:												
Baguio	75.6	8.5	55.2	—4.3	65.0	1.6	79.2	1902	7.8	50.3	1902	—1.1
Simla	67.1		59.5		63.4		71.4	1902		51.4	1903	
September:												
Baguio	75.4	9.3	56.7	0.3	65.4	4.1	77.9	1908	6.5	53.6	1902	4.6
Simla	66.1		56.4		61.3		71.4	1902		49.0	1901	
October:												
Baguio	76.5	14.1	54.2	3.2	65.4	8.6	78.8	1906	8.3	50.4	1906	13.2
Simla	62.4		51.0		56.8		70.5	1907		37.2	1904	
November:												
Baguio	76.3	20.1	50.0	5.0	64.3	12.3	78.8	1907	13.4	43.7	1905	11.4
Simla	56.2		45.0		52.0		65.4	1901		32.3	1906	
December:												
Baguio	75.3	25.9	50.5	11.4	64.1	19.9	77.4	1906	15.5	47.5	1905	24.2
Simla	49.4		39.1		44.2		61.9	1906		23.3	1903	

Humidity.—Next to temperature, the most important climatic element is the humidity of the air. At Baguio the monthly mean of relative humidity follows approximately the distribution of the annual rainfall, but is rather high throughout the year. December and the months from January to April are the relatively driest months, May to October are wet, while November is characterized by a mean hygrometric state. Simla, owing to its height and continental position, has a relative humidity throughout the year except during July, August, and September. But even the mean for the last-named month is lower than for the driest month at Baguio.

Cloudiness.—Another climatic factor of considerable influence is cloudiness. The prevalence of clouds at Baguio as compared with Simla is explained by the fact that the former is largely affected by the moisture-laden air currents from the China Sea whose water vapors condense readily over the Baguio plateau, especially during the months of March, April, May, and June, thereby preventing the temperature from rising higher.

Rainfall.—The average rainfall of Baguio is heavy during July, August, and September; moderate during May, June, and October; moderate to light during April, November, and December; and light during January, February, and March; the mean annual amount being 3,711.4 millimeters (146.12 inches). Outside of the Archipelago this amount is surpassed only by the rainfall of Cherra Ponjee, one of the hill stations in India, which situated at an altitude of 1,313.3 meters (4,309 feet) receives an annual average amount of 11,146.5 millimeters (438.85 inches), and by that of some stations in Burma. Within the Philippine Islands there are two stations whose annual rainfall surpass that of Baguio, viz., Baler, on the eastern coast of central Luzon, and Capiz, on the northern coast of Panay Island, both almost at sea level.

Persons who are familiar with Baguio will probably wonder why it is that even the absolute minimum for a number of years is reported as above the freezing point, when the formation of a thin crust of ice on little pools of water is nothing uncommon at the mountain resort during winter time.

Equipment of Mirador Observatory.—In the beginning of the present year the meteorological station at Baguio was transferred definitely to the top of Mount Mirador, and the installation of the new equipment commenced. By the end of June all of the instruments were in working order and the new observatory began its regular work on July 1, 1909. The station is provided with the following instruments.

Meteorological instruments.—The equipment for meteorological observations is very complete, as may be seen from the following enumeration: One Friez anemograph, mounted on the highest crag of the summit,

at a distance of 34 meters north of the building. The recording apparatus of this instrument is of the type known as "quadruple register," since it registers—electrically—the direction of the wind, its velocity, the rainfall, and sunshine. It is located in the office of the observatory which is situated in the southeastern tower. One Richard anemograph is mounted on the roof of the tower which contains the office. This apparatus gives continuous records of wind directions and velocities on a register installed on the upper floor of the same tower. Two mercurial barometers and a Richard barograph have their places in the office already mentioned.

Meteor Park.—South of the building, at a distance of some 35 meters, is the meteorological park, an inclosure within which are mounted the following instruments: One Marvin electric heligraph, one Campbell sunshine-recorder, one electrically registering rain gauge. Moreover, the thermometer shelter also contains, beside the usual maximum and minimum, dry and wet bulb thermometers (black bulb in *vacuo*), one minimum thermometer for observing grass temperatures, and one Piché evaporimeter. Plate I shows the strange and fascinating sight offered by the depressions around Mirador in the early morning of some days, when they are filled with heavy fog. On the slopes of the mountain are distributed at different heights three additional rain gauges and a number of minimum thermometers, which latter serve to record the grounds radiation.

The microseismograph.—This instrument, of the Omori type, consisting of two horizontal pendulums, was built in the mechanics' shop of the Weather Bureau. The bob of each pendulum weighs 126 kilograms (256 pounds). The horizontal distance between the pivots and the centers of the weights is 72 centimeters (28.3 inches); the vertical distance from the points of suspension to the pivots, 155 centimeters (61 inches); the amplification 10. The periods of oscillation are slightly unequal, being 11.4 seconds for the pendulum swinging E–W component. The apparatus is mounted in the southwestern tower on a solid pier of stone and cement which rests on the native rock of the summit. It is expected that this microseismograph will record all of the important earthquakes of the world which have their origin at great depths. Some instances of disturbances recorded simultaneously at Baguio and Manila may be interesting.

Special telegraph line.—Through the generous interest taken in the work of the Weather Bureau by the Director of Posts, a special telegraph line has been constructed from the Baguio post-office to Mirador Observatory, which enables us to send the official time of the Archipelago directly from Manila Observatory to Mount Mirador.

Personnel.—The personnel in charge of Mirador Observatory consists at present of one chief observer, one third-class observer, one assistant, and one mechanic.

Wireless telegraph station.—It is planned to erect, either on Mirador, or on one of the surrounding, slightly higher hills, a wireless telegraph station for the purpose of distributing typhoon warnings to ships at sea within a radius of at least 600 miles, and of receiving their reports on meteorological conditions prevailing in their neighborhood. It is true that at present only Government vessels are equipped with radiographic apparatus; but the time is not far distant when such installations will be common on board the larger steamers. The realization of the idea is assured, unless exceptional conditions should be found to exist in the region to be traversed by the magneto-electric waves, such as would make wireless communication from and to Mirador impossible. Whether such disturbing influences are present or not will have to be found out by actual trial.

ANTIRINDERPEST SERUM, ITS PRODUCTION AND USE.

By Dr. C. G. Thomson, D. V. M.

Veterinarian in Charge of Serum Laboratory, Alabang Stock Farm, Alabang, Rizal, P. I.

Rinderpest has probably caused greater losses to owners of cattle than any other one disease. It has existed for centuries in Asia, was introduced into Europe about two hundred years ago and later into Africa. Millions of animals have succumbed to its ravages in different countries during the past two or three centuries. It may be readily understood why individuals and governments have made every effort in their search for some instrument to use in the suppression of so appalling a scourge. It was rinderpest that first called forth government aid in the support of veterinary colleges and the institution of veterinary police regulations. In the early ages, all of the crude drugs and treatments were applied to the disease, and with the advance of the medical sciences more progressive methods were made available. But no success was attained until after the discovery of the bacterial origin of disease, with the subsequent development of serum therapy and its application to rinderpest. Science experimented with all of the thousands of drugs and compounds of the pharmacist, but ultimately ascertained that the preventative for rinderpest could be obtained from but one source, *the body of the susceptible animal, in the form of blood-serum.*

Antirinderpest serum is the fluid portion of the blood of cattle which have been immunized against rinderpest and subsequently manipulated to a state of high resistance to the disease. It is administered by subcutaneous inoculation into cattle and carabaos, conferring upon them a period of immunity that may endure from one to four or five months, during which time they will not contract rinderpest even if exposed. It is merely protective, not curative in action, is of no value in any disease but rinderpest, and is harmless to any animal.

The method by which animals prepare substances which are active against disease is a very interesting study, not yet fully solved, and too complex a problem for more than superficial discussion here. A brief mention of the general theory will suffice. It is generally known that following an attack and recovery from an infectious disease, there ensues

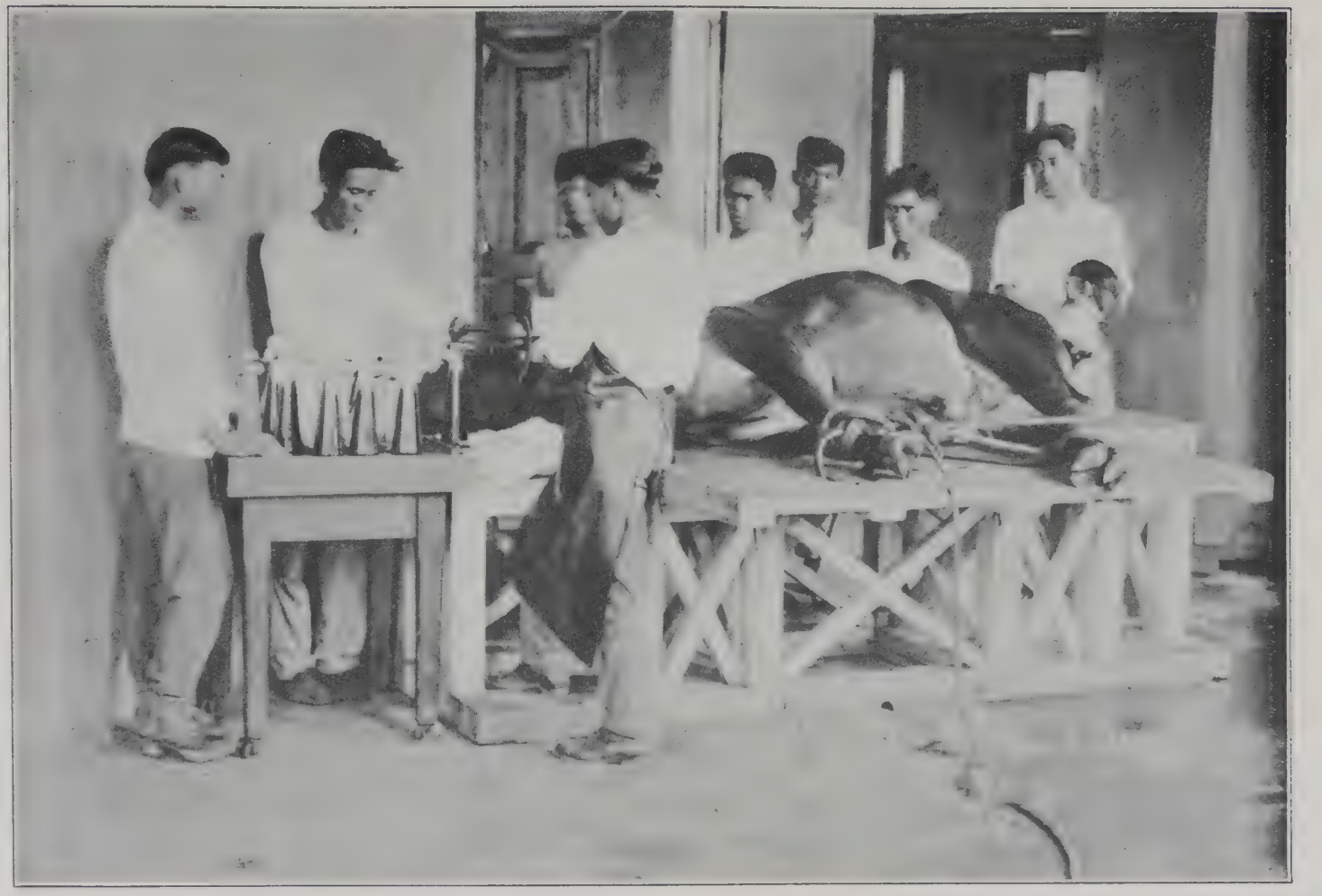

PLATE II.—BLEEDING AN ANIMAL FOR SERUM.

a period during which the animal is not susceptible to another attack of the same disease. The duration of this immunity varies in the different diseases. Following foot-and-mouth disease the immunity is for but a few months at best, while in rinderpest it is permanent. This immunity is due to the presence in the blood of certain substances called "antitoxins," substances which have been prepared by the body forces by reason of the stimulation afforded by the presence of the disease germs. These antitoxins destroy any similar germs that may subsequently enter the body.

The harmful action of various disease germs is exerted through poisons which they prepare and set free in the body. That is, bacteria, gaining entrance into an animal, do not create disease or cause death mechanically, by reason of their mere physical presence, but by means of poisons, toxins, which they produce. This is true particularly of the more severe diseases of animals and men, such as rinderpest, diptheria, and tetanus. Similarly, the body in its effort to overcome and eliminate the disease, prepares its substances, antipoisons or antitoxins, which are poisonous to the bacteria. The bloodserum and certain forms of cells are credited with the production of these antitoxins. They are carried in solution in the blood, and circulate into all portions of the body, to encounter and neutralize the toxins, and inhibit the multiplication of the germs. Thus the entrance of disease germs into the body is followed by a struggle between the toxins of the germs and the antitoxins prepared by the body. As in any battle, the issue depends upon the strength and numbers of the combatants. If the bacteria win, the animal dies; if the body wins, it is because it has prepared sufficiently powerful and numerous antitoxins, set them free in the blood, and thus neutralized the toxins and destroyed the germs.

In rinderpest, the antitoxins are retained indefinitely, circulate in the body fluid and perpetually guard against another infection by rinderpest germs. Not only will these antitoxins protect the immune animal from the disease, but if his blood be drawn and the serum inoculated into a susceptible animal, it will also serve for the latter's protection. In other words, the antitoxin is active when withdrawn from recovered animals and injected into others. It is this fact that permits of serum treatment.

An animal that has just recovered from rinderpest and is therefore immune, is not ready for serum production, as its blood does not contain the requisite number and strength of antitoxin to protect an animal which is inoculated with a small dose of serum. It is true that if a large amount of blood were drawn, the serum separated and inoculated into another animal, the protection afforded would be ample, but this course is not practicable. For economy and convenience it is necessary to produce a powerful serum, so that a small inoculation will furnish

the desired degree of protection. In order to accomplish this strengthening of the serum, it is necessary to administer gradually increasing doses of the germs of rinderpest, which, while harmless to the now immune animal, cause him to produce more powerful anti-toxins to neutralize the injected virus. These injections are given in a regular series, a larger dose being given each time, until a stage is reached when the animal is considered as fit for serum production and is bled.

In the preparation of antirinderpest serum, practical application is made of this theory. But few animals are immune to rinderpest when admitted into the serum herd, so the first step necessary is to pass them through the disease. A mild form of rinderpest is induced by the inoculation of a small amount of virulent blood and a large dose of serum. The serum is given to inhibit the action of the disease, so that the animal will recover after enduring a light attack of rinderpest. The more violent symptoms seldom develop in animals so treated. If the serum were not given, a mortality of about 90 per cent might be expected, but with its use the percentage is reversed. Usually the disease is in evidence within a week after the injection of virulent blood, and subsides after another ten days. The animal has now experienced rinderpest and is immune for all time. The blood serum contains the normal antitoxins of immune animals, which must now be stimulated to much greater activity.

The immune animal is maintained under good care and careful feeding until normal tone and good flesh is recovered, and then injected with a larger dose of virus, 10 cubic centimeters being given at this time. Neither this nor any of the succeeding injections is followed by any visible reaction. About ten days later, 100 cubic centimeters is injected, and ten days later this is followed by 500 cubic centimeters. A week later, the animal is bled the first time. Subsequently, at certain intervals between bleedings, injections of 1,000, 1,500, 2,000, 2,500, and 3,000 cubic centimeters are given. Three bleedings are made in as many weeks between each of the series of injections of virus. Following the last bleeding after the injection of 3,000 cubic centimeters of virus, the work of immunizing the animal is completed and it is sold at public auction. The process of hyper-immunization could be carried a few steps further, but it is abandoned at this stage, the cost of the virus being out of proportion to the advantage of maintaining the same animal in the herd.

In the production of any serum it is necessary to use large amounts of the virus of the disease against which the serum is to operate. In some cases the germ may be isolated and grown artificially, but this is not true of rinderpest. The only known method of obtaining rinderpest virus is from the bodies of sick animals. A quantity of virulent blood must be available about twice a week. For this purpose small male

cattle are infected with rinderpest and bled to death at the stage when the temperature is at maximum height, when the blood contains the most powerful toxins, and more blood may be obtained than at a later period when the animals are emaciated by the assault of the disease. Two hours before death, 10 to 15 liters of a weak saline solution is introduced into the abdominal cavity at body temperature, and is secured after death. It is used for injection in the same manner as the blood, being of nearly equal virulence, and producing similar reaction. By the use of this abdominal fluid we double the quantity of virus obtainable from each animal, reducing by one-half the expenditure for animals for virus. This class of animal is bled to death from the carotid artery.

In bleeding for serum the animals are confined on an operating table and the blood withdrawn from the jugular vein by means of hollow needles connected by rubber tubes to special serum flasks, from which the air has been exhausted to facilitate the passage of blood. Three liters is usually taken from each animal at one bleeding. No ill effects attend the operation, unless a slight dizziness, that is ocassionally observed, is worthy of mention. The blood is received into tall cylindrical flasks, kept at room temperature for six hours and then placed in cold storage for the balance of twenty-four hours. During this time the blood coagulates, a firm clot drawn by means of side tubes with which the flasks are provided, and is ready for use after being passed through fine porous filters for sterilization. For shipment into the provinces the serum is put up in bottles of 300 cubic centimeters, enough for the inoculation of six animals. Every flask, bottle, tube, and instrument used in connection with the production of serum is subjected to sterilization by steam heat, and every possible precaution taken to prevent contamination.

The important essentials for satisfactory serum animals are size, youth, docility, general soundness, and susceptibility to rinderpest. Chinese steers are in many ways the best animals in the East for serum purposes, but very few of this type have been available during the past year because of the prevalence of infectious diseases at the sources of supply. The serum herd is at present made up largely of Indo-Chinese animals, which are larger but more difficult to handle and maintain in good condition. The cattle are highly fed, as otherwise the continual bleeding would result in emaciation. They are stalled in large open sheds, being allowed several hours exercise in the pastures each day, excepting one day immediately preceding and one day following bleeding or inoculation. It might be said that they enjoy their existence at the laboratory, as it is certainly an easy one. Each animal is retained for about a year and then sold, bringing considerably more than its purchase price, the added value lying in its immunity to rinderpest and good condition upon discharge from the herd.

At present the serum herd is composed of about three hundred head, all of which are in actual use for serum production. With this large herd the weekly production has averaged 180 liters, or sufficient to inoculate over 3,000 cattle or carabaos with the usual dose of 50 cubic centimeters.

In the field work against rinderpest, the serum is injected subcutaneously by means of hypodermic syringes, each animal treated being given a dose of 50 cubic centimeters. There is but slight pain attendant upon the injection, as it is performed with small needles that are merely thrust through a loose fold of the skin. Excepting with very nervous animals, it is unnecessary to confine the cattle during the operation otherwise than in rough stocks. The antitoxin is active almost immediately after the injection, as the serum is rapidly absorbed into the blood. The serum is perfectly harmless, the inoculation being followed by neither a local nor a systemic reaction. There is no reason why a moment's time should be lost from work, excepting the time necessary to bring the animal to the place appointed for the inoculations, the one or two minutes necessary for the injection, and its return to the field.

The degree of protection afforded animals by the inoculation of 50 cubic centimeters of serum varies considerably, because of differences in their natural susceptibility, in the virulence of each outbreak, in the strength of the serum, and other more remote causes. The usual result is an immunity extending over a period of from one to four or five months. During this time the inoculated animals are as a rule immune to infection despite possible exposure. A small percentage of treated animals are infected in spite of the inoculation, but in these the disease is usually in light form and a majority recover. These light attacks and recoveries are highly desirable from the owners' viewpoint, as they result in permanent immunity of the affected animals. They interfere with the work of the Bureau, however, as an animal suffering from a mild form of disease may spread the contagion as rapidly and widely as one which experiences an acute form and eventually dies.

The Bureau of Agriculture has been preparing and using anti-rinderpest serum for about three years, during which time almost uniformly good results have been obtained in handling rinderpest by the serum method. For a long time there was a disinclination among owners to assemble their animals for inoculation, but more recently little difficulty has been experienced in effecting the necessary treatments.

A few complaints have been registered against the serum, as inoculations fail at times to produce the desired immunity. It must be borne in mind that there is no serum or treatment for any disease that will be efficient for every individual. Even with the most powerful serum it can not be hoped that every treated animal will escape infection. Anti-rinderpest serum, properly prepared and kept, will protect over 90 per cent of treated animals, as shown by the results obtained during the

PLATE III.—INOCULATING AN ANIMAL IN THE PROVINCES.

past two years. In the fiscal year of 1907, a total of 16,495 animals were inoculated, with 269 reported deaths, a mortality of 1.6 per cent. In 1908 a total of 21,005 were treated, with a mortality of 621, or 2.95 per cent. It is improbable that all deaths following inoculation were reported.

A majority of justified complaints are attributable to the serum being aged when used. It is of delicate organization, deteriorating rapidly unless kept cool, and is particularly susceptible to the action of the sun. As cold storage is seldom available in passage of freight, serum may be considered as losing in efficiency with each day following shipment from Manila.

There is prevalent in some quarters a mistaken impression that the serum is a curative agent. As has been often pointed out, its action is almost wholly preventative, but slight benefit being derived from inoculation of sick animals. The serum, injected before disease has fastened upon an animal, may combat entering germs and prevent their provoking the anatomical changes characteristic of rinderpest, but after these changes have occured the serum is practically worthless.

In the suppression of any infectious disease, the object in view is the destruction of the germs of the disease. In Europe and America, where funds are available for the purpose, this is accomplished by the slaughtering of all animals that are sick or exposed, and the disinfection of all infected premises. Indemnity is paid for all animals destroyed, and the carcasses are either burned, disinfected chemically, or buried at a depth that precludes the possibility of infection rising from that source. This is of course the best method of handling infectious diseases, but is not possible here at present because of the lack of funds to indemnify owners of destroyed animals. In the absence of means to handle rinderpest in this way, the method now in practice is the best that can be pursued.

The theory involved in the serum method is the rendering immune of all susceptible animals in infected districts, the confining of the sick in corrals, the limitation of the movement of susceptible animals so far as possible, and the disinfection of infected premises. As in the other method, the effort is toward the destruction of the virus, but less directly, the idea being that all animals having been rendered immune for the time being by serum inoculation, the disease will be checked automatically because of the want of susceptible animals in which to propagate. Further spread of the infection is controlled by the isolation of the sick, that they may not come in contact with the healthy animals. The object in establishing quarantine lines to control the exit of carabaos and cattle is to prevent the carrying of the contagion by animals which are in the initial stages of the disease and therefore not readily recognized as having it.

It is unnecessary to add that it has never been possible to accomplish

perfectly the four essential principles, viz, (1) inoculation of all susceptible animals, (2) isolation of the sick, (3) quarantine, and (4) disinfection of infected areas. It is difficult to gather every animal for inoculation, even if the supply of serum is ample, which has seldom been the case. Owners of sick animals often conceal them to prevent their isolation. Lawless individuals too often evade the quarantine lines, escaping with their animals into clean districts and spreading the disease as they go. The infected areas are often so large that complete disinfection is impracticable.

To a great extent, the chief factors that have interfered in the work have been attended with the public's lack of knowledge of the general conditions tending toward the spread of the disease. This is of much less significance now, as stock owners are taking a keener interest in the problem, and expressing this interest by more satisfactory coöperation.

Rinderpest, because of its short period of incubation, ready identification, limitation to ruminants, short life of the virus in the sun, and availability of serum therapy, is more readily suppressed than some of the other infections diseases, providing it is possible to institute ideal conditions in the work. Failing in any of these conditions, it is one of the most difficult to handle, because of the extreme rapidity with which the contagion of rinderpest is disseminated.

The rapid elimination of rinderpest as a grave factor in the economy of the Islands seems assured, now that the entrance of the disease has been impeded by legislation, satisfactory quarantine facilities have been provided for cattle at each port of entry, a large corps of veterinarians have been stationed in the provinces, the serum laboratoy has been improved to meet the increased demand for serum, and the public aroused to the necessity of intelligent activity in their own defense.

THE LAW PROVIDING PERMANENT ANNUAL APPROPRIATIONS FOR BOUNTIES TO THE GROWERS OF LEAF TOBACCO.

ACT 1767 BY THE PHILIPPINE COMMISSION.

Whereas there has been for several years a decrease in the amount of leaf tobacco produced in these Islands and a deterioration in the quality thereof, due to faulty and unscientific methods of planting the seed, caring for the growing leaf, and the subsequent curing thereof when harvested; and

Whereas this condition of affairs has resulted and is resulting in injury to the tobacco-manufacturing industries of these Islands and to the export trade in leaf tobacco and the manufactured products of tobacco: Now therefore,"

By authority of the United States, be it enacted by the Philippine Commission, that:

SECTION 1. Section one of Act Numbered Seventeen hundred and sixty-seven is amended by Act 1917 to read as follows:

"Beginning with the calendar year nineteen hundred and nine, and each year thereafter, there shall be paid bounties to growers of tobacco under the following conditions:

"(*a*) Three thousand pesos in the Province of Cagayan, three thousand pesos in the Province of Isabela, two thousand two hundred and fifty pesos in the Province of La Union, to be expended in bounties for the encouragement of the tobacco-raising industry, under the rules and regulations to be made by the Director of Agriculture, subject to the approval of the Secretary of the Interior.

"(*b*) Each of the provinces named in the preceding paragraph shall be divided into districts not to exceed four in number in each province by the Director of Agriculture, subject to the approval of the Secretary of the Interior.

"(*c*) In the Provinces of Cagayan and Isabela sums not to exceed four hundred pesos each, and in the Province of La Union a sum not to exceed three hundred pesos may be expended out of the funds hereby appropriated, in each calendar, year, for the traveling expenses, per diems, or any other expenses of the committee hereinafter provided for. Growers of leaf tobacco desiring to compete for the bounties provided

for above shall register as competitors with the provincial treasurer at the time of planting each year's crop, or as soon thereafter as practicable, and the treasurer of each province shall by frequent publication, not less than once a quarter or oftener if advisable, by *bando* or otherwise, in each town inform all growers of leaf tobacco regarding the payment of these bounties and the steps necessary to be taken to enter the contest. A standing committee in each province is hereby constituted to pass on the claims of the various competitors. Said committee shall be composed of the provincial treasurer, a representative from the Bureau of Agriculture to be designated in each province by the Director of that Bureau, and a third member to be a planter of or dealer in leaf tobacco in each province to be selected by the other two members of the committee. This committee shall convene on the call of the provincial treasurer, shall provide such rules for the discharge of its commission as may be needed to suit local conditions in each province, and their report each year on the names of the growers of leaf tobacco entitled to the various bounties shall be in the form of a certified resolution signed by the three members of said committee and forwarded to the Governor-General of the Philippine Islands. A copy of said resolution shall also be forwarded to the Insular Auditor and a copy to the Collector of Internal Revenue and the Director of Agriculture.

"(*d*) The balances appropriated in section one (*a*) hereof shall in each province be equally divided among the several districts, so that each district shall receive its proportionate amount, said amount to be subdivided into two parts. The first part shall be distributed in the proportion of fifty per centum, thirty per centum, and twenty per centum to the growers, in their order of merit, of leaf tobacco in said district who plant not less than one hectare nor more than ten hectares and who produce the largest number of marketable leaves per hectare. Leaves taken from rattoons or suckers shall not be considered a part of the crop on which awards are to be made. The second part shall be distributed in the proportion of fifty per centum, thirty per centum, and twenty per centum to the growers, in their order of merit, of leaf tobacco in said district who cultivate not less than one hectare nor more than ten hectares and who sort the tobacco leaves harvested on such holding in the most uniform manner as regards the size, quality, coloring, and so forth, of the leaves."

SEC. 2. Section two of Act Numbered Seventeen hundred and sixty-seven is amended by Act 1917 to read as follows:

"A permanent continuing appropriation to pay the committee expenses and bounties above specified is hereby made, and the Insular Auditor shall, upon the approval of the Director of Agriculture, pay the former by warrant direct, and the latter to each grower entitled thereto by warrant, in the name of such grower, to be delivered to him by the provincial treasurer and to be paid out of the Insular Treasury from

any moneys not otherwise appropriated. The names of the successful competitors shall be published in the Official Gazette and in the local press."

SEC. 3. In addition to the amounts provided for bounties to be paid in the three provinces designated a continuing annual appropriation of five thousand pesos for general distribution in other tobacco-growing provinces, under the direction and with the approval of the Governor-General, is hereby made and shall be assigned and paid to the competitors for said bounty in the remaining tobacco-growing provinces, as near as may be in accordance with the regulations provided above for the three provinces designated.

SEC. 4. The public good requiring the speedy enactment of this bill, the passage of the same is hereby expedited in accordance with section two of "An Act prescribing the order of procedure by the Commission in the enactment of laws," passed September twenty-sixth, nineteen hundred.

EXECUTIVE ORDER NO. 56, JULY 9, 1909.

In conformity with the provisions of Act Numbered Nineteen hundred and seventeen, amending Act Numbered Seventeen hundred and sixty-seven, Executive Order Numbered One hundred and eleven, series of nineteen hundred and eight, is hereby amended to read as follows:

"Pursuant to the provisions of section three of Act Numbered Seventeen hundred and sixty-seven, and beginning with the calendar year nineteen hundred and nine, and each year thereafter, the sum of one thousand pesos shall be expended in bounties for the encouragement of the tobacco-raising industry in the Province of Iloilo, under the rules and regulations to be made by the Director of Agriculture, subject to the approval of the Secretary of the Interior.

"The Province of Iloilo, for the purpose of distributing bounties, shall be divided into two districts by the Director of Agriculture, subject to the approval of the Secretary of the Interior.

"A sum not to exceed two hundred pesos may be expended out of the funds hereby appropriated, in each calendar year, for the traveling expenses, per diems, or any other expenses of the committee hereinafter provided for.

"The balance available after paying expenses of the committee provided for in the preceding paragraph shall be equally divided between the two districts, said amount to be subdivided into two parts. The first part shall be distributed in the proportion of fifty per centum, thirty per centum, and twenty per centum to the growers, in their order of merit, of leaf tobacco in each district above provided for who plant not less than one hectare nor more than ten hectares and who produce the largest amount of marketable leaves per hectare. Leaves taken from rattoons or suckers shall not be considered a part of the crop on which

awards are to be made. The second part shall be distributed in the proportion of fifty per centum, thirty per centum, and twenty per centum to the growers, in their order of merit, of leaf tobacco in each district above provided for who cultivate not less than one hectare nor more than ten hectares and who sort the tobacco leaves harvested on such holding in the most uniform manner as regards the size, quality, coloring, and so forth, of the leaves.

"Growers of leaf tobacco desiring to compete for the bounties provided for above shall register as competitors with the provincial treasurer at the time of planting each year's crop, or as soon thereafter as practicable, and the treasurer of the province shall, by frequent publication, not less than once a quarter, or oftener if advisable, by *bando,* or otherwise, in each town, inform all growers of leaf tobacco regarding the payment of these bounties and the steps necessary to be taken to enter the contest.

"A standing committee in the Province of Iloilo is hereby constituted to pass on the claims of the various competitors. Said committee shall be composed of the provincial treasurer, a representative from the Bureau of Agriculture to be designated by the Director of that Bureau, and the third member to be a planter of or a dealer in leaf tobacco in each province to be selected by the other two members of the committee. This committee shall convene on the call of the provincial treasurer, shall provide such rules for the discharge of its commission as may be needed to suit local conditions, and their report each year on the names of the growers of leaf tobacco entitled to the various bounties shall be in the form of a certified resolution signed by the three members of said committee and forwarded to the Governor-General of the Philippine Islands. A copy of said resolution shall also be forwarded to the Insular Auditor.

"The methods to be followed in Iloilo shall be assimilated to those provided for in Act Numbered Seventeen hundred and sixty-seven, as amended by Act Numbered Nineteen hundred and seventeen for the Provinces of Cagayan, Isabela, and La Union.

"The names of the successful competitors shall be published in the Official Gazette and in the local press."

THE MANGO.[1]

By H. H. Cousins, *Director of Agriculture for Jamaica.*

Some two years ago, the late Capt. L. D. Baker, the founder of the banana trade in Jamaica, came to Hope Gardens and stated his opinion that the department would be wise to devote a large part of its energies for some years to come to furthering an export trade in mangoes.

"You grow the mangoes" said Captain Baker, "and I will build the ships to carry them."

Further attention to the possibilities of the mango as an article of export from Jamaica has resulted from the remarkable returns recently obtained by Mr. Aston W. Gardner of Kingston in shipping high-class mangoes to London. Some years ago Mr. Gardner obtained through the kindness of Sir Henry Blake, the governor at the time, some newly received plants of grafted mangoes from India. One of these has now grown into a fine tree and produces large crops of a very choice mango that is not in the collection of mangoes grown by the department. During the past season Mr. Gardner shipped these fruits to England and received £70 for the produce of this one tree. The prices varied from 1 shilling 6 pence to 2 shillings 6 pence per fruit. During the past season we have sent from Hope to various expert horticulturists in America samples of all the ordinary varieties of mangoes grown in Jamaica.

The common mangoes, kidney mangoes, and black mangoes carried badly and were not appreciated, while "No. 11" was considered a superior fruit. The best results both in keeping and in edible properties were invariably obtained with the "Bombay" mango [2] introduced into Jamaica by Governor Sir John Peter Grant, and known in other West Indian colonies as "Peter's." This mango is free from fiber, has a small stone and possesses a delightful subacid flavour with a mellow luscious quality that surpasses all other mangoes grown in Jamaica. I am inclined to the opinion, therefore, that Sir Peter's Bombay mango is the most promising variety to grow for export. It is a hardy tree of prolific bearing

[1] From "The Porto Rico Horticultural News," July, 1909.

[2] Retail prices in New York on the new Bombay Governeuer mango, weighing from a pound to a pound and a quarter, range from $1 to $1.50 each. Ordinary Bombay mangoes are quoted at 50 cents each.

and frequently fruits quite freely out of season when mangoes should be in great demand in America. Remarkable success has frequently been achieved in shipping this fruit to America and England and its keeping qualities are exceptional.

Varieties of mangoes.—An exhaustive account of the history of the mango in Jamaica and a description of all the chief varieties then growing in the island by Mr. W. Harries, F. L. S., was published in the Bulletin for 1901, pages 161 to 178. Practically every mango tree in Jamaica is a seedling and although certain varieties appear to come fairly true from seed, there is undoubtedly a constant variation and no two "No. 11" or "yam" mangoes are strictly alike.

It is very regrettable that the fine collection of Indian mangoes introduced by Sir John Peter Grant in 1869 was set out at Castleton Gardens. In this situation the moisture of the air is so great that the mango gets into an unhealthy state and it is rarely possible for the flowers to be fertilized. Some of the varieties have not fruited yet, although forty years of age, and it must be admitted that the department has been very lacking in enterprise, until quite recently, in extending the best varieties of Indian mango in Jamaica.

In 1904, the idea of budding mangoes was suggested by the publication of some successful experiments in Queensland. Mr. T. J. Harris, of the experiment station, operated on these lines and was the first person to bud mangoes successfully in Jamaica. The original tree was a fairly large yam mango of a good age. The buds consist of "Bombay" and "Alphonse" varieties and the rapid growth has enabled the new buds to restore the old tree to quite respectable dimensions at the end of the fourth year from budding. Fruit was borne for the first time when the buds were three years of age. This experiment is one that demonstrates the great possibilities for budding mangoes in Jamaica and it is hoped that during the next ten years many thousands of trees, at present bearing inferior fruit, many be converted into budded trees furnished with the choicest varieties of dessert fruit.

To test the practical aspects of the matter, it is now in contemplation to bud one thousand large seedling trees growing on the old slave quarters of the Hope estates, as part of the operations of the new farm school and thus secure a good trial of the possibilities of growing high-class Indian mangoes on ordinary wild trees. A stock of 105 grafted plants of the choicest varieties of Indian mangoes was obtained from the Calcutta Botanic Gardens and dispatched by the immigrant ship *Ganges* in September last. The plants arrived in capital order and the department will now be able to propagate these esteemed varieties and have them tested in Jamaica. The following varieties have been thus added to our collection of mangoes: Alphonse, Bombay, Fuzli, Singapur, Madras, Langra, Kisenbhog, Kemsagua, and Malda.

As at present advised, the "Peter's Bombay" should be selected as the most promising variety for cultivation for the export trade.

The variety "Alphonse" or "Afooz" is highly esteemed in India. The late Colonel Griffith of Hodges, St. Elizabeth, imported, at great cost, two trees of the Alphonse mango. It is possible, however, that "Alphonse" may prove too shy a bearer for profitable exportation in Jamaica and its cultivation can not at present be recommended. We have a large number of mangoes from all parts of the world under observation at Hope. So far, none have indicated any approach to "Peter's Bombay" as a commercial fruit. The majority are decidedly inferior varieties.

Hints on culture.—The mango, when grown naturally from seed, sends down a deep tap root and it is characteristic of young seedling mangoes that they root very deeply in the earliest stage of their growth. Experiments have shown that a good seed from a strong-growing variety (planted at stake), will give far quicker results in establishing a tree than a seedling set out from a pot. Indeed, in a dry district, the establishment of a mango transferred from a pot to the soil is always a matter of considerable uncertainty. It is desirable therefore, when setting out an orchard, to plant seeds of the yam or other strong-growing variety of mango. When these are 1½ to 2 years old they should be stout little trees of just the right size for budding.

A distance of 30 to 40 feet should be allowed between the trees when developed. For quick returns from budded trees it is recommended to plant 15 feet by 15 feet or 20 feet by 20 feet and to cut out every alternate tree when the growth requires it.

With the mango, the young buds are not of use for budding. The buds from wood 1½ to 2 years old showing leaf scars on the bare bark, should be selected. It is useless to attempt budding unless the bark lifts freely. When the trees are flushing, the bark can be lifted easily and there is no difficulty in removing the buds with the slips of excised bark. Buds can be inserted either by cutting out a corresponding piece on the bark of the branch to be treated or the bud can be slipped under a T-shaped incision in the ordinary way. Raffia fiber is a good medium for tying in the buds.

In budding old trees, do not cut down the whole tree at once. The main branches should be cut off about a foot from the stem, taking care not to split the arm, smoothing the edge of the bark and protecting the cut surface with tar. When the new growth is 1 to 1½ inches in diameter it is fit to take a bud. When the buds have started to grow the rest of the branches can be cut down and similarly treated.

It is important to observe that an old tree cut off short below the main branches will probably die, and that care is required in lopping old trees not to remove the whole of the foliage at one operation. When

the new shoots have grown, the old stumps of the original branches should be carefully cut close back with a slope toward the trunk of the tree.

It is very important in pruning a mango tree to cut close to the main branch or stem so that the wound can heal rapidly. The bark should be bevelled with a sharp knife and the cut end treated with tar. Careless lopping of old trees will result in attacks of insects and fungi upon the exposed tissue and the death of the trees will be greatly hastened.

As it is now proposed for the department to test budded mangoes on an area of over 800 acres of land, we should in a few years have definite results upon which the commercial basis of the high-class mango as an article of export from Jamaica can be determined. I am convinced that those planters who take up the work of improving the mango by budding in those districts of the island where it fruits well and freely, will reap a rich reward in the future.

The choice East Indian mango is not only a most grateful fruit to the palate of any normal person but it also possesses a fascination for those who have acquired a taste for the fruit that bespeaks an ever-growing demand when this, the most luscious fruit of the tropics, is made accessible to the peoples of America and Europe.

THE CATTLE OF SOUTHERN INDIA.[1]

By Lieut. Col. W. D. Gunn,
Superintendent Indian Civil Veterinary Department, Madras.

The cattle of the Madras Presidency have long been famous, and of the several breeds which are to be found in this part of the country those designated the "Mysore," and the "Ongole"—sometimes known as the "Nellore"—are undoubtedly preëminent. On account of its prepotency the former is most assuredly entitled to first honors, as a visit to all of the various large cattle fairs held in the southern districts of Trichinopoly, Madura, and Tinnevelly, also in the more northerly districts of Anantapur and Bellary, will show how this type predominates.

The "Ongoles" are very beautiful in appearance, and for their special purpose are unsurpassable, but they differ in almost every respect from the Mysore. They are huge in size, extremely docile, and suitable for steady heavy draft, whereas the Mysore cattle are specially adapted to road work, as they are quick, very high spirited, and have extremely hard, sound feet.

Indian cattle, like those of Europe, vary in most districts as to size, form, and symmetry, or as to the growth and length of their horns—according to the local peculiarities of climate, soil, and last but not least, fodder. It may be stated that both natural and artificial fodder tend to influence the form, size, and character of an animal. Ordinarily the native who lives on a meal of rice, and perhaps a few herbs to season the same with, expects that his cattle will, in like manner, pick up what they can in the way of pasture about the village or its adjacent lands, so that he never troubles himself to grow green feed, or to prepare dry fodder for them; the same plant which supplies him with grain feeds his cattle with its straw. In most towns and villages cattle are driven out at all seasons to graze abroad; in the dry season they more frequently lick the dust only, and return home with their stomachs as empty as when they started, to receive perhaps only a few handfuls of straw or rubbish, just sufficient to sustain life.

[1] Extracts from "Cattle of Southern India," Bulletin No. 60, Vol. III, Dept. of Agriculture, Madras, India.

Madras is essentially a cattle-raising province, and consequently its animal wealth is enormous, but, as in other presidencies of India, large herds of village or mongrel cattle are to be met with everywhere. Many of them are worthless, being too weedy even to put into the lightest plow, and they are allowed to exist and eat the ration of the more profitable ones. Undoubtedly religious sentiment among the vast majority of the people is averse to destroying cattle, as among the Hindus the bull has always been regarded as sacred, and worshiped under the name of *Nundi*, as it formed the vehicle of their deity Shiva during his peregrinations. A Hindu would consider it a most grievous sin to kill one of the cattle, and an utter pollution to partake of their flesh, yet he freely partakes of their milk.

The great centers of cattle raising are shown in the accompanying map (Pl. IV), and from these they are taken by dealers, who form a very large community, to the numerous annual and weekly markets held in this presidency. For guidance, a list of the fairs and the weekly markets, also the approximate number of animals which are brought for sale, has been added at the end of the paper. Frequently drovers have their regular customers, and they receive payment by installments, but this custom is principally limited to the northern and western districts. Mysore has enjoyed from a very early period a just renown for a superior breed of cattle. The generally mild and salubrious climate of the plateau, with an extensive pasture on which cultivation has not made much inroad, favored cattle breeding and attracted Gollas and other nomadic tribes from the north, who brought with them their excellent breeds which, being established for generations in the country, and mixing with the indigenous population, could not fail to improve them. In a country in which 9 per cent of the population subsist by agriculture, where cattle play a most important part, a demand for them is never wanting. Cattle manure is used as fuel or serves to enrich the soil. The operations of plowing, harrowing, sowing, and thinning the crop, of lifting water from wells for irrigation purposes, are carried on almost entirely by bullocks. The crop when cut is removed to the thrashing floor, and there trodden out by the cattle, and transported by them to market; in fact it would be difficult for the Indian cultivator to get on without his cattle, which constitute the life and soul of agriculture. The substance of the *ryot* is usually estimated by the number of cattle he owns, and the number of plows he work. Moreover, cattle are intimately associated with the domestic life of the people. The present of a cow and land is a part of the Brahminical obsequies. When a relation has died a young bull is presented to the deity as a propitiatory offering, to be eventually turned loose into the herd and become a sire.

BREEDS OF INDIAN CATTLE.

The following breeds of cattle are the principal ones that have attracted attention, for which in consequence there has been the greatest demand at the cattle shows and fairs held in the presidency.

1. Mysore breed (A) Amrat Mahal.
2. Mahadeswarabetta or Alumbadi breed.
3. Nellore breed.
4. Kangayan breed.
5. Pulikolum, Jellicut breed.
6. The Kappliyan breed.
7. Gumsur breed

These breeds are found principally in the following districts:

1. Ganjan.
2. Vizagapatam.
3. Godavari.
4. Kistna.
5. Guntur.
6. Kurnool.
7. Bellary.
8. Anantapur.
9. Cuddapah.
10. Nellore.
11. Chingleput.
12. Madras.
13. North Arcot.
14. South Arcot.
15. Salem.
16. Coimbatore.
17. Nilgiris.
18. Malabar, and Anjengo.
19. South Canara.
20. Trichinopoly.
21. Tanjore.
22. Madura.
23. Tinnevelly.

TWO KINDS OF INDIAN CATTLE.

All over the presidency, so far as cattle breeding is concerned, two descriptions of cattle exist side by side; this is particularly noticeable in Mysore, also on the east coast where the Ongole breed is found. The first is known as *Nadudana* or *Natudana,* really village cattle, which are by far the most numerous, of small size, compact frame, and various colors. Every village in the province teems with them. They constitute the bulk of the agricultural stock, and are the main source of the dairy supply, such as it is. The second class is known as the *Doddadana* meaning large cattle, and consists of the less numerous but more efficient and valuable kinds, of more uniform size and color; they are more often used in conveying the traffic of the country than in agriculture, and are largely sold in cattle markets. *Doddana* and *Nadudana* are particularly Mysore terms. The *Doddadana* embrace the Amrat Mahal, Hallikar, Chitraldroog, Alumbadi, or Mahadeswarabetta, and kindred breeds. These breeds are owned only by well-to-do *ryots* and breeders. There are professional breeders, but every *ryot* who has a little capital adds to his agricultural occupation that of rearing a few head of cattle. There are breeders who keep their herds of cows and bulls for breeding purposes mostly in the vicinity of grazing hills and lowland forests. Calves of a year old or so are bought from them by the *ryots,* who attend them with much care for two or three years, and then exhibit them for sale to the best advantage at the cattle fairs.

METHODS OF BREEDING.

The breeding operations in this part of India are carried on by means of three classes of bulls:

(*a*) Choice specimens of the *Doddadana* breeds kept in villages and home-fed or kept in the herds; they are licensed to graze on village crops and freely move with the herds in their jungle pastures; these may be styled *special superior breeding bulls.* The large majority of these have been dedicated to temples, and are thus held to be sacred.

(*b*) The calves of *Doddadana* cattle bought when young and reared in villages, destined for agriculture or for sale after castration, but employed as sires meanwhile. These may be styled *casual good breeding sires.*

(*c*) The numerous small sized and more or less ill-shaped young males of the *Nadudana* or *Natudana* class herding with the village cattle; these undoubtedly lead to degenerate breeding; they may be called *Nadu bulls.*

Nadudana or village cattle are left entirely to the course of nature without any control, and without any of those artificial restrictions by which a breed can be saved from degeneration. Seldom is any selection made of breeding cows or bulls with reference to their fitness for producing healthy progeny, neither are inferior and defective bulls generally castrated; the common practice of driving all of the village cattle, male and female, together in one herd leads to indiscriminate breeding.

In some parts, however, it is the custom for one or two villages to club together and subscribe for a superior bull which is carefully selected and purchased when young. It becomes the common property of the villagers, is allowed to graze on private fields, and keeps in excellent condition. They are allowed to run to the field crops and graze their fill either after the herd has returned home for the night, or before it is let out in the morning. Cows of the *Doddadana* class are kept in the villages under shelter and are home-fed, in which case only the very best bulls are secured for serving them. Each herd has its own special superior bull sometimes selected from the same herd, but more often from some other herd to prevent in-and-in breeding.

HOW TO JUDGE MYSORE BULLS.

It may be of interest to know what the breeding experts consider the best points of a Mysore bull of the best quality, and these, though they can not be met with in a single specimen, are more or less searched for in all careful selections:

(1) A long and stretching frame.

(2) A good height—say 52 inches measured behind the hump.

(3) A long and tapering head, with a narrow and prominent forehead.

(4) Small but prominent and bright eyes.

(5) Small and erect ears.

(6) Thin, fairly long and gracefully set horns. The difference between their thickness at the base and at the end being small.

(7) Strong, fairly long neck with a small, well-shaped hump.

(8) Thin and short dewlap.

(9) Broad and full chest.

(10) Well-formed and strong shoulders and hind quarters.

(11) Strong and well-rounded ribs.

(12) Level back and broad loins.

(13) Narrow flanks.

(14) A level croup. An abruptly falling croup being condemned ("goose rumped" in horsey phraseology).

(15) A thin, short, whip-like tail reaching to or very little below the point of the hock.

(16) A well-projecting anus ring, so that the ejected dung may fall clear of the body. It should not be situated in a niche-like hollow, as in cows and old animals.

(17) A sheath having little or no pendulous growth.

(18) Legs of medium length and well proportioned, having strong and fairly thick bones, straight, not turned sideways or brushing against each other and moving in perfect rhythm.

(19) Short fetlocks, hard and small hoofs with equal halves, having a very narrow cleft between them. A long shank bone is considered a weakness.

(20) The color of the horns, hoofs, muzzle, and skin should be black.

(21) The skin should be thin and satiny, having short and soft hair. Bluish and iron-gray colors are preferred.

(22) A compact body free from all pendulous growths.

(23) The animal should be sound in every way, of symmetrical features, of good temper and pure breed, and free from hereditary diseases. In the selection of the cow no such special attention is bestowed as in the case of the bull, which, considering the number of animals it is likely to influence, is most carefully selected. The main points looked for in cows are good size, length, shapely head and horns, broad hips and loins, and nice color.

AMRAT MAHAL (MYSORE) BREED.

Among the breeds found in Mysore the first place is undoubtedly due to the Amrat Mahal. The Amrat Mahal, literally Milk Department, is an establishment for the breeding of a race of cattle peculiar to the country of Mysore, and these cattle at present comprise three principal varieties called, (1) Hallikar, (2) Hagalvadi, and (3) Chitaldroog, from the districts which originally produced them, and so distinctive are the characteristics of the cattle bred in this establishment that they may readily be

distinguished from any other breed in India. The different breeds composing the present Amrat Mahal cattle owe their origin to the cattle of the tribe of *Gollas* and their subtribe of *Hallikars* who, with their superior cattle, are believed to have migrated in ancient times, in several successive waves, from the north, and settled in different parts now comprised in the Chitaldroog and Tumkur districts.

Strength and endurance.—The attention of the British was first called to the excellence of this breed when it enabled Hyder Ali to march 100 miles in two days and a half to the relief of Chellumbrum, and after every defeat to draw off his guns in the face of the enemy; and when Tippu Sultan was enabled to cross the peninsula of southern India in one month for the recovery of Bednore, and to march 63 miles in two days before General Meadows. It also enabled the Duke of Wellington to execute those marches of unexampled rapidity which are the admiration of military men, and the Duke brought it prominently to the notice of the then commander in chief, Lieutenant-General Stuart. Captain Davidson, in a report on the Amrat Mahal cattle attached to the Bombay column of the English army in Afghanistan in 1842, says: "No draught cattle in either army were so efficient as the 230 Mysore bullocks which accompanied the Bombay troops to Afghanistan. It was entirely due to this very superior description of cattle that no part of the Bombay Park was required to be abandoned when the troops were returning to India over the almost impracticable roads through the Tirah Mountains. These cattle were frequently upwards of sixteen hours in the yoke. The draught bullocks of the Bengal army were the property of the government, and were not in my opinion as fine animals as the Mysore bullocks."

In 1808 the commissioner of Mysore said of them: "They are active and fiery, and walk faster than troops; in a word they constitute a distinct species, and are said to possess the same superiority over other bullocks in every valuable quality that Arabs do over other horses." Professor Wallace remarked in 1899 that the breed as a whole occupies among cattle a position for form, temper, and endurance strongly analogous to that of the thoroughbred among horses.

Registration, etc.—Stud books have been opened, and cattle are mustered by name and brand. Births and deaths are registered and reported in monthly returns, and frauds on the part of subordinates have been to a great extent prevented. This is very necessary as they have been living in practically a wild state.

Herding and care.—The Amrat Mahal cattle are kept in their grazing grounds, called "kavals," which are about 210 in number. These kavals are distributed over the greater portion of the western and central parts of Mysore, and cover an inmense tract of country. They comprise a variety of soils, and are often undulating and covered with scrub jungle growth. The cattle feed on various grasses, though "vunaga" (*Heteropogon contortus*) is by far the most predominant. The grazing in the

kavals situated in the valleys is most nutritious. As the country becomes more elevated the grass becomes more scanty, and inferior in quality. The kavals are divided into (*a*) hot weather, (*b*) wet weather, and (*c*) cold weather kavals according to the season of year at which they are most suitable for grazing.

The cattle are divided into "serwés" or herds, each of which, with its attendants, is kept separate and distinct. The establishment of each herd is fixed at two hundred breeding cows, one hundred heifers, twelve bulls, and twenty "peshros" or leaders, with the calves of both sexes and all ages, the actual produce of the herd, the number of which varies according to circumstances, but which, generally speaking, raises the total number of animals in each herd to five or six hundred head. Each serwé or herd is placed in charge of a "serwegar" assisted by two "mundals" each of whom is responsible for the proper management of the cattle under his charge. An establishment of graziers and other attendants is likewise attached to each herd. The number of kavals alloted to each herd varies from three to nine, according to the size of the kavals and the quantity of pasturage they afford, and although the herds are not supposed to be permanently attached to particular kavals, still they are not removed from those which have been allotted to them without special reasons. All of the herds taken together are divided into fourteen "tukries" or divisions, some composed of two, and others of three herds, the kavals belonging to each herd being of course, conveniently situated. Each "tukri" is placed under the superintendence of a "daroga" whose duty it is to frequently inspect the herds, to muster the cattle, to check and report all irregularities on the part of the attendants in charge of them, also to arrange as far as may lie within his power any difference which may rise with the inhabitants or local authorities. At the annual inspection of the cattle which takes place in the vicinity of the grazing farm, in the months of July and August, each herd is separated, carefully examined, all inferior cattle removed and unmarked cattle branded.

In disposition these cattle are wild, unruly and impatient of the presence of strangers; it requires several months of kind treatment and patience to break them in. For days together they are kept on starvation allowance of fodder, and when they are weak and subdued they are gently handled by the keeper, to whom, by degrees, they become accustomed. They require to be gradually habituated to the yoke, and harsh treatment only makes them stubborn.

Breeding.—Early castration is the rule in the department; the calves are castrated when they are eighteen months old in the cold season.

The bullocks are separated from the herds after they are 4 years of age, and those sold to the Madras government are transferred to the public cattle department at Hunsur, and when 5 years old they are thoroughly trained to work. They are in their full vigor at 7 years, and past it at

12. They work until they are 14 or 15, after which they rapidly decline and die at about 18 years of age.

As dairy stock.—As dairy stock, the cows are insignificant, being very poor milkers. The whole of the milk is barely sufficient to nourish the calves—other use of it is strictly forbidden. Good cows yield about one *seer*[1] each time; i. e., twice daily, allowing as much for the calf. The milk is very rich and sweet.

It is said that heifers in the Mysore district generally give birth to their first calf in the sixth year and are termed "mukkundies." In the Hassan, Tumkur, and Kadur districts they reproduce for the first time in the fifth year, and are then said to be "ikkundis." Those in the Chitraldroog district and Channagiri taluk are regular "varshakundies;" that is, they commence calving in their fourth year. This information, I feel sure, is very unreliable as circumstances alter cases very considerably. Provided that the heifer is well fed from birth she will probably come in season at the end of her first year, and generally speaking in a year of good rainfall the heifers come into season quite early. Twenty cows are allowed to one bull. The bull is not used until he is 5 years old and is said to retain his vigor until he is 10, after which he is castrated and discarded from the herd. It is said that cows, although in good condition, do not get in season while in their "malnad kavals" owing to exposure to rain and wet, but when they are turned into their "maidan kavals" they breed in large numbers. The most favorable time for breeding is when pasture and water are abundant, and the most favorable months for births are January and February and from August to December.

The calves remain with their mothers during the day, but are separated from them at night and sheltered in folds. When they are 3 months old they are able to graze and begin to subsist on pasture. In the cold season when the herbage is abundant they are generally weaned when 5 months old; such as are born later in the year can not be separated from their mothers until after the hot weather. After separation care is taken to conduct them to the richest pastures in the neighborhood, but they are not supplied with food beyond what they can graze on pasture.

Prices.—The average prices may be stated to be as follows:

Very good breeding bulls 80 to 130 rupees,[2] average bulls from 50 to 65 rupees. Very good cows 60 to 90 rupees, average cows 40 to 60 rupees. A pair of first-class bulls are said to be worth, in Hyderabad, as much as 500 rupees and even 800 rupees. People in the Dharwar collectorate eagerly seek these cattle and pay good prices for young bulls from 2 to 4 years old, as much as 100 to 150 rupees. It is said that a

[1] One seer is an Indian unit of measurement equivalent to about 2 avoirdupois pounds.

[2] Rupee is an Indian coin equivalent to 48 centavos, Philippine currency.

pair of bullocks having won a race in dragging a heavily laden car through sandy soil was sold there for 800 rupees.

The serwegars of the Amrat Mahal department have been allowed the privilege of keeping their own cattle with the government herds with the consequence that the Amrat Mahal bulls have crossed the *Nadudana* cows and the result has been mongrel, and these, from long association, have taken on all the characteristics of the Amrat Mahal. They are now known by the name of "Egosu" or "Swantagosu" cattle.

MAHADESWARABETTA OR ALUMBADI BREED.

This breed derives its name from its chief market Mahadeswarabetta in the Killegal taluk of the Coimbatore district, where two large cattle fairs are held in February and in October, at which the cattle exhibited are mostly of this description. It is also called the Betsal or Cauvery breed from its hilly home on both sides of the Cauvery, but probably a more common name is that of Alumbadi, called after a village of that name on the bank of the Cauvery. The chief habitat of this race of cattle is in the Kankanahalli taluk of the Bangalore district, and the northern taluks of the Coimbatore and Salem districts which are divided from Mysore by the river Cauvery. The reason for these regions teeming with great herds of cattle is the wide expanse of forest land which is scarcely fit, or has not yet been taken up for cultivation, and with only patches of tillage in favored spots, it affords herds of cattle abundant pasture and wide and unrestrained roaming ground. These tracts are stony on the elevations and humus in the valleys. The forest growth being all deciduous, the pasture lands are thoroughly baked in the hot weather by the heat of the sun, which is so peculiarly intense in the low hilly regions of the valleys. Another reason, though of secondary importance, is the noble stream of the Cauvery whose waters are utilized for irrigation higher up in Mysore, and fertilizes some of the richest tracts in southern India lower down; in these regions it runs through scenery of wild grandeur, on a bed too deep for irrigation purposes, and affords cattle a perennial supply of water in seasons when the country becomes parched up and thirsty.

Beyond these jungle centers, but bordering on them, large herds of this breed are also kept in villages commanding extensive pasture. Cows and bulls of this breed, in small numbers, purchased from these large herds are taken away and reared in Maidan villages of the Kolar, Bangalore and Mysore districts. It is from these breeding-tracts that all the cattle of this kind are exported to other districts, and to foreign ports such as Penang, Singapore, Java, and Colombo. An average of 9,000 large powerful animals have been exported from Negapatan to Penang alone during the past few years. Nearly all the large cart bullocks used in Southern India are obtained from this source. The

whole habitat of the breed is favorable to the development of bone. These cattle are more massive and are of larger build than those of the Mysore type found elsewhere, though they are often found wanting in symmetry of form. A good specimen should have the following points:

Head short and stout with thick muzzle and broad forehead; eyes more or less prominent, black and gentle with the surrounding thick skin overhanging; horns both as uniform as those of the Amrat Mahal being shorter and stouter, and in most cases have a sharp turn backward toward the upper half where they come very close together; ears long and generally erect; neck short and thick; dewlap thick, broad and in folds, sometimes continuing backward to the sheath; hump large and well developed; back is seldom straight, usually inclines from the croup to the cowlick in the back and from there gently rises to the hump; the ribs are well arched and strong; the sheath is deeply pendulous; the hump droops from the croup to the tail and is usually narrower than is consistent with symmetry; the legs are short with plenty of bone; the feet are large and the halves usually unequal, consequently the feet are ordinarily tender, and often require shoeing; the skin is thick, loose and generally of a brown color; the tail is usually thick at the root long and abruptly tapering.

NELLORE BREED.

The Nellore breed of cattle has a wide reputation throughout India, and even beyond its limits. Formerly the principal breeding localities were situated within the northern taluks of the Nellore district of the Madras Presidency, but recently these taluks have been included in the new district of Guntur, so the cattle should not rightly be given the name of Nellore but rather that of Ongole, from which tract the best specimens of the breed are obtained.

It was formerly noticeable that cattle breeding received most attention in those parts of the country where circumstances of one kind or another were adverse to the extensive prosecution of agriculture. The cultivators were repeatedly deprived of the results of their labor, and were consequently considerably harassed; they, therefore, as a substitute devoted their time to raising large herds of cattle of a superior kind which were then much in demand, and which they saved from the grasp of the officials by moving them from place to place. Under more secure government, these cattle breeders settled down, and being a fairly wealthy class retained their pride in the fine cattle in their possession, with the result that many beautiful specimens may now be seen in this part of the country. The very best examples are to be found in the villages of Karumanchi, Nidamanur, Pondur, Jayavaran, Tungutur, and Karavadi in the Ongole taluk, and in Elapalapadan, Nenurpad, and the hamlets along the banks of the Musi in the Kandukur taluk. Fine cattle of this breed may also be found in the taluks of Vinukonda and Narasaraopet

in the Kistna district. In the southern part of the Nellore district, where wet crops are grown, the cattle are much inferior, not being so well cared for or fed as in the places above named.

The system of feeding observed by the *ryots* of the different parts of this country naturally depends upon the extent of the pasturage. In the low-lying parts where paddy is principally grown, a certain portion of dry land is often kept as a pasturage for cattle. Most of the cattle, however, leave the villages during September and October—the southern rainy season—and are sent to the western taluks where there are extensive waste and jungle tracts. Part of the working cattle will occasionally follow the other cattle during November and December, should the pasture land of the village not be sufficient. The *ryots* often club together and send their cattle away in large herds. For this purpose, prior to the departure of the cattle from the village, arrangements are made for renting pasture blocks at a fixed sum for the season (October to February), or engagements are entered into with the holders of the pasture farms for the pasturing of the whole herd for the season at a small fee per head for each full-grown animal. Should the northeast monsoon be favorable and extend till late in the season, the cattle are only pastured until January when the paddy is harvested, after which there is very fair grazing. The whole of the jungle grazing is not open to the cattle at all times, for after a heavy burst of rain, invariably experienced about October, the best portion of the pasturage is preserved and kept clear of cattle for one or two months until grass has grown up well, when the working cattle alone are turned in and kept thereon so long as the pasturage suffices, another portion being similarly kept for the other cattle. Toward the end of January when the sorghum crop on the higher land has come to ear, the young shoots termed "zadu," which are not likely to mature, are removed and given to the bullocks, which are often picketed close to the fields. Ocasionally fields in the midst of cultivation are set apart for pasture, and are planted with the black and white varieties of acacia. After being under grass for ten or twelve years, the ground is cleared of trees and broken up for cultivation. The trees shade the ground and favor the growth of grass, while the pods form good fodder. The pasture land held in this way is invariably distinct for each *ryot*, and is generally kept exclusively for working cattle, young stock, and milch cows.

The country where the best cattle are raised is an undulating highland interspersed with small hills, and is mostly composed of light red or dark alluvial soil, where good sorghum, other millets, and legumes are raised. The well-to-do *ryots* in these parts find their pleasure and pride in raising fine cattle.

There is no greater trusim than that which refers to the necessity of feeding young stock, and the very great care which the best breeders

bestow on the young animals, both male and female, most certainly accounts for the well-deserved reputation of the Ongole cattle. The young calves are allowed to suckle the whole of the cow's milk, and when they are 3 months old are given grass and a small amount of mixed grains. In every way they are treated and tended as the family pets, and it is only by going into the houses of the villages that the best calves can be seen.

That there is considerable profit in the undertaking is evidenced by the high prices which they realize for animals. Young bulls sell from 80 to 250 rupees. Several fine animals have been exported to South America. A good Nellore cow is worth from 80 to 150 rupees, according to the amount of milk she yields.

"Ghee" (clarified butter) is made in fairly large quantities, and sold to merchants for export, being seldom used by the *ryots* who prefer gingelly oil for cooking, and reserve the ghee for sale. A good Nellore cow gives from 11 to 14 pounds of milk daily.

The breed is probably not so hardy as the Mysore or Alumbadi, but for slow heavy work they are unsurpassed, and they are universally employed for drawing very heavy loads, frequently amounting to five tons, in the city of Madras.

The characteristics of the breed are—

Head.—Face moderately long, muzzle fine; forehead broad; eyes elliptical in shape, large and mild; skin around the eyes is black for about half an inch; ears long and drooping; horns short and inclined to be stumpy—in cows the horns are longer than in bulls—they are directed outward and slightly backward.

Neck.—Short and thick.

Hump.—Well developed.

Body.—Massive, long and deep, but some are inclined to be flat-sided. In fine specimens, the girth behind the hump is about 84 inches, and height behind the hump 63 inches.

Back.—Of moderate length and invariably higher at the croup.

Quarters.—Strong, with a considerable droop.

Sheath.—Pendulous—cows have also a fold of skin in the position of the sheath.

Tail.—Long, fine and tapering.

Legs.—Strong, and somewhat coarse.

Feet.—Large and somewhat soft looking.

Color.—Black and white and pure white, the latter is not most esteemed, but formerly black and white was the predominating color.

Temper.—Very docile.

The extensive pasturage in this part of the country is no doubt responsible in a great measure for the large cattle-breeding industry, which the Government has always been careful to foster. Previous to 1867 a poll tax used to be levied, but in that year this was abolished in Nellore,

and a principle was laid down for the future that, out of the waste of each village, an area equal to 30 per cent of the area occupied by cultivation should in future be reserved for common grazing to be equally enjoyed by all villagers free of charge; the surplus waste, if sufficient in extent to make it worth while to adopt the system, may be leased out for one or two years at a time to the highest bidder.

In order to further develop and encourage the breeding of good stock, an annual cattle show was established as far back as 1858, and continued uninterruptedly until 1871. During these twelve years a total of over 18,000 rupees was distributed in prizes. The cattle show was resuscitated in 1904 with most successful results, and it is doubtful whether such a large collection of bulls and cows of one breed was ever brought together before in India. There were exhibited:

Brahmini bulls	45
Bulls	120
Bull calves	83
Bullocks:	
Single	22
Pairs	31
Cows	166
Heifers	132
Buffaloes:	
Bulls	1
Bullocks	9
Cows	6
Rams	38
Ewes	3
Goats:	
He	11
She	3
Total	670

The heifers and young bulls were an exceedingly good lot, and it is most sincerely hoped that, with the encouragement held out by the Madras government, the show will be held annually and be equally as representative. The cattle show at Ongole has now become a regular institution, and has continued to grow in popularity. It would therefore be a very great pity if it were allowed to drop for want of funds and government support, as this breed has become world renowned. During 1906 buyers came from Brazil and about 200 young cattle were taken away to this distant country where the breed has become very popular.

Great care is taken in the selection of the village bull; and the collection of Brahmini bulls brought into the show at Ongole consisted of 45 handsome upstanding animals in splendid condition. Almost every village has one or two so-called Brahmini bulls, which are common property, having been presented by some wealthy *ryot,* by the relations of a deceased villager as a memorial, or having been purchased by public subscription. Such animals are always branded with a sacred mark.

KANGAYAM BREED.

This breed is also known by the names *Kanganad*, *Kongu* and *Kangaen* and derives its name from the taluk of the Kangayam.

These cattle are bred in the southern and southeastern taluks of Coimbatore. There are said to be two varieties, a large and a small. The smaller are found to be more numerous in the Kangayam, Dhárápuram, Udamalpet, Pollachi, Palladam, and Eorde taluks, while the larger variety are more prevalent in Karúr, Aravakurichi, and Dindigul taluks. It is understood that the celebrated Kangayam breeds are not the common cattle of Kangayam, but are the property and product of large breeders such as the Pattagar of Palaiyakottai and his family, the Kadiyar Munsiff Monigar, etc., who maintain herds of from 500 to 1,000 head, and keep large numbers of cows and bulls for breeding only. Many *ryots,* however, own from 10 to 20 head of cattle reared for sale. These cattle are sold, not at ordinary markets, but to dealers who come to the district for the purpose of purchasing, or at large cattle fairs such as Avanashi, Mahadeswara Hill near Kollega, and Madura. The breed in its purest form may be seen in the herd of the Pattagar of Palaiyakottai who has been an extensive breeder for many years.

It is curious to note that the animals seen at the several cattle fairs held in what is practically the home of this breed are not nearly so good as animals of the same breed which are sold at fairs in the southern districts. There are probably two explanations for this, first, that it is not profitable to export any but selected animals, and second, purchasers select the very young male stock and these are taken away to good grazing grounds where they are well fed, but the fact remains that better pairs of bullocks of this breed are to be met with in the Madura and Tinnevelly districts than in the neighborhood of Kangayam.

It is doubtful whether there is another landowner in India who pays so much attention, or carries out systematic cattle breeding on such good lines as this Pattagar, and this only shows what can be done if due attention is paid to the essential requirements.

Both varieties of this breed are strong, active animals with compact bodies, and short stout legs. In the larger variety the horns are much longer, and of different shape from those of the small. They curve outward and almost complete a circle at the point where they approach the tips, and for a distance of three or four inches have a sharp backward curve. The prevailing color is pure white. The Pattagar of Palaiyakottai is the breeder of the small variety, a description of which is as follows:

Head, short with broad, level forehead, eyes dark and prominent, ears short and erect, horns spreading apart, straight, short and thick with sharp points; neck, short and thick; hump, moderately developed; dewlap, thin and reaching to the sternum only; body, compact and well ribbed; back, short, broad and level; quarters, strong, slightly drooping;

sheath, not pendulous; tail, short and thin; legs, short and of good bone; feet, small and hard; the prevailing colors are white, and gray and white with gray shoulders and quarters, also red, black and broken colors are to be found. Among the *ryots* there is no selection of bulls; the Seami or Brahmini bull is usually the village herd sire, but there can be little doubt that cows are also served by the young uncastrated stock.

It is not customary to afford shelter against the sun or rain, but the cattle are protected against the furious winds which prevail in southern Coimbatore by screens of bamboo mats and branches which are formed into a pen. These pens are moved at intervals of one or two days, and in this way the whole field becomes manured. In this way also ticks which are a great pest to cattle, and increase where cattle are confined, are prevented from fixing on them.

The following is the daily routine of cattle worked in gardens. At 6 a. m., the *ryot* gives his cattle water, either with or without bran, after which they work at the plow or well till 12 noon; they are then tied up under the shade of a tree, watered, and fed. Special food consisting of bran, cotton seed, and gram, which is soaked and ground, is given in addition to a full ration of straw or as much as it can eat. At 2 p. m. work is resumed and continued until 6 p. m. The animals are then tied to pegs in the garden or taken to the house, and straw is given in small quantities at intervals during the night. The straw ration consists of stalks of *cholum, cumbu, ragi, tenai, samai, varagu,* paddy, *chola chukka* (top of the *cholum* containing ears after the removal of the grain) and *collu thiri* (the pods of horsegram after removal of the seeds). As a rule no special feeding is given to cows or bullocks not in work. The cattle graze on the harvested fields and the few fields which lie fallow or on any waste land. Some few *ryots* in Kangayam reserve lands for grazing on which Kolakuttai grass is grown.

PULIKOLUM OR JELLICUT BREED.

Other names have been given to this breed and they are sometimes known as Kilakad or Kilkattu. This is a very numerous breed, and although a fair number are bred in the various villages in the Madura district by far the largest breeding operations are conducted in the south-west of Madura; large numbers are also raised in the vicinity of the Cumbum Valley and the Perraya River where there are grazing grounds of vast extent. There is a big breeder living near Madura at Cholavandanniya, by the name of Iyengottai Mamzakkarar, who owns about 1,000 head of cattle, and who exhibited same at the Madura Cattle Show held in 1907. The young bulls which he stated to be typical of the breed were rather small, but otherwise there was little fault to be found with them. They were very compact, with stout legs and hard feet. The loins, shoulders, and neck very powerful, and both were capable of doing very good work. He wanted 100 rupees each for these bulls, but this class of cattle may usually be purchased for about 35 to 50 rupees

each. These cattle, as a rule, are comparatively small in size, but are very active and capable of much endurance. In many of the villages in south Madura certain of the small bulls are kept for the purpose of bull fighting or rather bull baiting, and are known as Jellicut, which means an ornament of leaves, from the fact that the horns of the bull are usually decorated with a vividly colored cloth. The method of baiting is as follows. A colored cloth is firmly tied round the horns of a bull, and he is then set free. A number of men then attack it and endeavor to untie the cloth which the bull, having now become extremely excited, resents. It naturally shows fight, and has generally to be thrown down, and both hind legs held before the cloth can be untied. It is not an uncommon occurrence for men to be injured, and even killed, but nevertheless the sport is most popular. Bulls selected for this purpose are fed and well cared for. They are kept apart and fed by the owner only, so as to make them savage toward strangers. To show how popular this sport is, I may say that hundreds of these bulls are kept for this sole purpose.

In many points they resemble the smaller sized variety of the Konga or Kangayams, but they are finer bred, and give the impression that they have in them a strain of the Mysore blood, and this is highly probable. The larger ones are extensively used for coach work, and they are capable of trotting continuously 5 or 6 miles an hour. The cows are poor milkers.

Description.—Head of moderate length, fine muzzle, forehead fairly broad; horns widespread and curved inward having sharp points; ears short and erect; eyes quick and prominent; neck short and stout; hump well developed; dewlap narrow, thin and extends only to the chest; body compact and well ribbed; back, broad, short, and slightly higher at croup; the quarters strong and level; sheath adherent to the body; legs short, strong and well set, usually grey and white; tail long with large tuft of hair.

KAPPILIYAN BREED.

A tribe of people called the Kappiliyans of Cumbum in the Madura district have a herd, not very numerous, of a somewhat distinctive breed. This tribe is of Canarese origin, and still speaks that language. Mr. Francis, in the Gazetteer of Madura, gives a most interesting account of them. In describing them he says that they are small, active, round barreled animals well known for their trotting powers, which the people themselves declare are descendants of some cattle which they brought with them when they first came to these parts. They are called the Devarn Avu in Canarese or in Tamil the Tambiran Madu, both of which phrases mean "the sacred herd."

The cows are never milked, and are used only for breeding. Members of the herd which die are buried, and are not, as elsewhere, allowed to be desecrated by the skinning knife.

The leader of the herd is called "the king bull" *palladu avu,* and when he dies a successor is selected in a quaint manner, with elaborate and expensive ceremonial. On the auspicious day fixed for the election, the whole herd is assembled, and camphor, plantain, betel-nut, etc., are solemnly offered to it. A bundle of sugar cane is then placed before it, and the attendant Kappiliyans watch eagerly to see which of the bulls of the herd will approach and eat this. The animal which first does so is acclaimed as the new "king bull" and is formally installed in his office by being daubed with saffron and kunkuman and garlanded with flowers. Thereafter he is treated by the whole caste as a god, is given the holy name of *Nandagopalaswami,* and is allotted to watch over and worship him a special attendant, who enjoys the *inams* which stand in his name, and is the custodian of the jewels and the copper grants which were presented in days gone by to his predecessors. There are now nine of these grants, but they do not state the Sakka year in which they were drawn out, and the names of the rulers are not identifiable.

The herd receives recruits from outside owing to the Hindus round about dedicating to it all calves which are born on the first day of Thai, but these are not treated as being quite of the elect. The Kappiliyans have recently raised 11,000 rupees by taxing all members of their caste in the Periyakulam taluk for three years, and have spent this sum in building roomy masonry quarters at Cumbum for the sacred breed. Their chief grievance is that the same grazing fees are levied on their animals as on mere ordinary cattle which, they urge, is equivalent to treating gods as only the equals of men.

GOOMSUR BREED.

This is a very small variety of animal found to the north of the Ganjám district. They are very symmetrical in shape and active, and are largely used for cart work in the district. All over the taluk of Goomsur there is extensive grazing ground which is very suitable for the rearing of cattle but they never attain any size. In 1908 a cattle show was inaugurated at Berhampur, the chief town of the district, and handsome prizes were offered for the best cattle, but it being the first show ever held in the district it was unfamiliar to the people. It is, however, anticipated that in time it will become a valuable institution, as on the first occasion it was very well attended.

The following is a description of a typical Goomsur bullock.

Head small with flat face and broad forehead; horns medium size, curving outward and inward; eyes mild but intelligent; body square, compact and well ribbed with strong loins and hump fairly well developed; height behind the hump 42 to 46 inches; dewlap thin, reaching only to the sternum; sheath adherent to the body; feet good, hard, and sound; tail reaching to the hocks, fine and whippy with a large tuft of hair at the end; color usually light gray.

CATTLE FAIRS HELD DURING 1906-1907 IN THE MADRAS PRESIDENCY.

District and taluk.	Month.	Approximate number of cattle.	Breeds offered for sale.
Ganjám	February	1,000	Gonsur and mixed breeds.
Gódavari	Every week	3,500	
Kistna	March; every week	2,400	Principally Ongole and Kistna.
Guntúr	March	1,200	Pure Ongle.
Bellary	January	11,000	Ongle and Mysore.
South Arcot	Every week	3,150	Mysore and Kangayam.
Vizagapatam	February	1,000	East coast breeds.
Salem	January to April	2,100	Kangayam.
Coimbatore	June	1,500	Kangayam and Mysore.
Trichinopoly	January	50,000	
Madura	February to April	25,000	Pollikulum.
Tinnevelly	Every month	66,000	Mysore and Pollikulum, Alambadi, Kangayam, and local breeds.
Malabar	December	10,000	Local breeds.
South Canara	November	[a]	Do.
Kolar	February and April	31,000	Nearly all Mahadeswarabetta.
Sidlaghatta	do	14,000	Nandi, Mastidana, and "Nadudana."
Bowringpet	February and May	10,000	Local breeds.
Malur	April	21,000	Do.
Mullegal	March and May	25,000	Do.
Chikballapur	March	18,000	Do.
Koratgeri	January	3,000	Mahadeswarabetta and Hallikar.
Pavgada	do	3,000	Pavgada, Mahadeswarabetta, and "Nadudana."
Honnali	February	6,000	Mahadeswarabetta, Chitraldroog, Amrat Mahal and "Nadu."
Yadatore	January	7,000	Hallikar, Bettadapur, Metikuppé, Mahadeswarabetta, and "Nadudana."
Nelamangala	March to April	11,000	Mahadeswarabetta, Masti, Nandi, and "Nadu."
Hoskote	March	3,000	Mahadeswarabetta, Hallikars, and "Nadu."
Dodballapur	January	30,000	
Anekal	April	5,000	
Magadi	do	3,000	

[a] Very large collection.

CURRENT NOTES.

THE PHILIPPINE LABOR BUREAU.

The Philippine Labor Bureau, under Director Manuel Tinio, formerly governor of Nueva Ecija Province, and Assistant Director Bernardino Monreal, former governor of Sorsogon Province, is already doing some good work in the way of assisting to solve the labor problem for many of the employers of labor in Manila. Director Tinio has taken an important part in adjusting the difficulties between the tobacco workers and the employers in several of the different tobacco factories in Manila.

The Bureau also conducts a free employment agency through which it endeavors to furnish laborers and skilled workmen of all kinds to employers. It has sent a number of laborers to Baguio for employment by the Bureau of Public Works. Help has also been furnished to the Alhambra Cigar Factory, the Manila Trading and Supply Company, Rizal University, Meerkamp & Co., and the California-Manila Lumber Company, besides some departments of the Government and numerous private individuals.

THE ILOILO-CAPIZ RAILWAY.

The work on the railway line between Iloilo and Capiz, the capital of Capiz Province, is reported as progressing slowly, the principal difficulties having been the large cuts and fills near the boundary of the two provinces, and the inability of the company to get sufficient labor to carry on the work. About the middle of November the rails were laid into the town of Dumarao; from Dumarao to Capiz comparatively rapid progress should be made down the Panay Valley to Capiz.

FREE TRADE BENEFIT TO VISAYAN SUGAR PLANTERS.

During the month of September there were 19,827,054 kilos of sugar exported to the United States from Iloilo on three vessels. If this sugar had been exported prior to the enforcement of the provisions of the Payne bill, the Insular Government would have received ₱19,827.06 as export duty, at that port, and the further sum of ₱1,106,349.60, as import duty, would have been paid in the United States, making a total of ₱1,126,176.66 in revenue to the Government. This large sum of money was saved by the growers, buyers, and purchasers. This loss of

revenue by the Government is a direct benefit to the people of the Philippine Islands and to the business men of Iloilo and the growers of Panay and Negros. The loss to producers through the old order of things was to the purchaser in China. The Chinese buyer paid no more for sugar than it was worth shipped to another market. The United States tariff barrier simply gave him an advantage in the market and he made the amount of the duty which otherwise would have been paid to the Government.

NOTE ON ANNATTO.

According to a letter recently received by the honorable the Secretary of the Interior from Messrs. L. E. Ransom & Co. of New York, acknowledging the receipt of samples of annatto seed shipped to them during the month of May, the samples sent to them were too dry and dull in appearance to suit the buyers of this article. The trade demands very red and fresh seed as there is considerable loss in strength when the seed becomes dry. According to this communication the price for annatto remains unchanged.

TWO CROPS OF RICE A YEAR IN THE CAMARINES.

The question of harvesting two crops of rice in one year in the Philippines was recently taken up by "La Paz," a weekly newspaper published in Ambos Camarines. This publication states that Mr. Manley harvested from his plantation in the municipality of Bula a crop of rice which was planted in March and April of this year. These same fields were planted in September and October of last year and a good harvest was obtained in January and February of this year. As soon as the harvesting is completed the land will be prepared for another crop of the same grain.

This experiment is sufficient to show that the lands in this section are capable of producing two harvests annually. It also proves that carabaos can work continuously during the year, and that they do not need a rest during the dry season. Some farmers believe that it is necessary for their animals and lands to lie idle for several months during the year. It is believed that the farmers in Pili, Minalabac, Bula and Nabua, adjacent to Mr. Manley's plantation will study the methods used by him and harvest two crops a year in the future.

MEETING OF THE DAVAO PLANTERS' ASSOCIATION.

On October 4 the Davao planters, to the number of fifty, gathered in the district capital for their annual meeting and banquet. The preparations for this meeting were made under the direction of Mr. F. A. Crowhurst, president of the Planter's Association, and Mr. O. Hansen, the secretary. Among those present on this occasion were Maj. C. E. Standen, Mr. J. E. Lenhart, and Doctor Dade. The latter, who is a Kentuckian and thoroughly familiar with the conditions which obtain in the tobacco districts of the United States, spoke of the manner in which

the tobacco districts fell into the hands of the trusts and of the organization of the Tobacco Growers' Protective Association, pointing out their eventual triumph over the trust, and how the prices for their products were fixed, not by the trust, but by the growers' association. In conclusion he urged the planters' association of Davao to continually strive for perfect organization and through such an organization to defend their rights as growers.

INDUSTRIAL EXHIBIT BY THE SCHOOLS AT THE CARNIVAL.

The exhibit of the different schools of the Bureau of Education will be under the direction of Mr. George N. Briggs, superintendent of the Philippine School of Arts and Trades. The exhibit is to contain not only articles made by students in the different industrial schools of the Islands, but will show students actually at work on all kinds of industrial exercises carried on in the schools.

It is proposed to exhibit the following finished products:

(*a*) *Shop manufactures in wood.*—Tables, chairs, flower stands, picture frames, sideboards, plate racks, trays, magazine racks, chessboards, and such other articles as are made in the industrial school shops.

(*b*) *Domestic science exhibit.*—Cloth woven in schools, articles of wearing apparel made by the girls, embroidery and lace, and exhibits from the cooking department, such as preserved and dried fruits.

(*c*) *Minor industries.*—Hats, mats, baskets, hammocks.

(*d*) *Exhibits from the iron-working departments of the trade schools.*

(*e*) *Agricultural exhibit.*—Products grown in school gardens.

"PHILIPPINE RESOURCES."

A new magazine published by Mr. Daniel O'Connell, former Secretary of the Manila Merchants' Association, appeared November 1, under the title "Philippine Resources," with the following table of contents:

Gold Mines in the Philippines.
Leading Agricultural Products of the Philippines.
Commerce.
Carnival of 1910.
Oil Fields of Tayabas.
Possibilities in Coffee Culture.
Improvements in Manila.
Attractions in Manila.
Amusements in Manila.
Dawn of Prosperity.
Civil Service Pensions.
Climatic conditions.

There seems to be a most excellent opening for a magazine of this character and it is to be hoped that this effort by Mr. O'Connell will be most heartily supported by the merchants and business men, not only

in Manila, but in all parts of the Islands. There is certainly a great need of publicity regarding the resources of the Islands and it is believed that much of this work can be accomplished through the magazine which Mr. O'Connell has undertaken.

MISAMIS CARNIVAL EXHIBIT.

The provincial board of Misamis has voted money to build an exhibition building on the Carnival grounds at Manila next February and to pay the expenses for the transportation of exhibits. A central committee has been appointed and subcommittees will be appointed in every municipality which intends to send exhibits. Mr. W. K. Bachelder, acting division superintendent of schools, has been asked to urge teachers and pupils to make as large and interesting an exhibit of the work done in the schools as possible.

ILOILO CUSTOMS RECEIPTS.

The monthly report of the acting collector of customs for Iloilo, Mr. D. E. Fee, shows that the total collections at that port for October, 1909, were ₱13,044.46 more than for the corresponding month of last year. This increase is largely due to the increase in the collections for wharfage, which exceeded by ₱22,958.64 those of October, 1908. The duties collected on imports fell off ₱4,934.14, and those on exports from ₱5,993.78 to ₱346.84. During the month 16,940,561 kilos of sugar were shipped to the United States.

CATTLE FOR PANAY AND NEGROS SUGAR PLANTATIONS.

About the last of September the Norwegian steamer *Fri* and the inter-island steamers *Mauban* and *Islas Filipinas* arrived in Iloilo with loads of cattle for sugar-estate work. And on October 28 the inter-island steamer *Churruca* arrived in Iloilo from Manila with a cargo of draft cattle for the sugar plantations of Negros. From this it will be seen that the sugar planters are preparing to harvest a large crop next year.

NATURAL GAS IN THE PHILIPPINES.

While pumping out an artesian well in the barrio of Santa Rita in Pampanga Province early in the month of October, workmen were surprised at seeing a flow of natural gas from the well on which they were at work. Doctor Adams, geologist of the division of mines of the Bureau of Science, visited the well on October 10. On his arrival, gas was found escaping from the well which was cased with a 2-inch pipe. On igniting the gas it burned with a flame of about 1 meter above the mouth of the pipe.

The following table by Mr. Rivers, of the Bureau of Public Works, gives a list of some of the wells where gas has been struck:

	Struck gas at (meters)—	Quantity.	Struck water at (meters)—	Quantity (liters).
Macabebe, Pampanga, Luzon	36.5	Flash	57.9	283.9
Manalan, Pampanga, Luzon	48.7	do	94.5	283
Santo Tomas, Pampanga, Luzon	38.1	Flame 3 meters high, burned 15 minutes then extinguished	87.0	454.3
San Jacinto, Pangasinan, Luzon	16.7	6 meters high; great force	[a]	None.
Lingayen, Pangasinan, Luzon	73.15	Flash		
Bay, Laguna	69.5	Small intermittent flame	69.5	22.7
Iloilo	47.2	Flash	[b]	

[a] Well cased and driven deeper. [b] Still sinking.

MANILA'S NEW STEAMER WHARVES.

According to the regulations recently issued by the Collector of Customs, the new wharves will be ready for the accommodation of vessels some time during the month of December. The Government will require the steamship companies to use the new wharves for the purpose for which they were constructed as fast as is practicable. The Government proposes issuing a regulation requiring the discharge of all general cargo arriving directly from the United States and entitled to free entry into the Islands onto the Government wharves by the carrying vessels. On September 23 the Collector of Customs addressed a letter to a number of the largest shipping concerns requesting their coöperation with the customs authorities for the purpose of making use of the new wharves constructed by the Government at the earliest opportunity. The Collector states that it is the opinion of those who have made a study of this matter that by using these wharves cargo will be handled for 50 per cent of what it now costs. The question of transportation from the piers to the warehouses of importers is the only one that remains to be solved.

PHILIPPINE NATIONAL ECONOMIC COMPANY.

From the proposition of Mr. Martin Ocampo, of "El Renacimiento," it would seem that some of the Filipino people are beginning to understand and to interpret the signs of the times. Mr. Ocampo proposes the capitalization of a large company or corporation by Filipinos for the purpose of carrying on large industrial and manufacturing enterprises in order that the Filipino people may have their share in the commercial development of the country.

Mr. Ocampo states that the time has arrived when all who were born in this country, rich and poor, individually and collectively, all classes should apply themselves to the urgent solution of the present commercial problems of the country, that if the Filipinos fold their hands and do nothing it is possible that their best opportunities will disappear before the enslaving wave of foreign capital. He believes that it is the duty

of the Filipino people to make the best of the situation and to form a formidable mercantile association, called the "Compañía Nacional Económica de Filipinas" with the object of engaging in the greatest possible number of commercial enterprises. For this purpose ₱200,000 of capital should be raised within the next six months. Mr. Ocampo suggests the establishment of a yarn or spinning factory, which is absolutely necessary if our native cloth is to compete with the foreign article; the establishment of life and fire insurance companies to compete with the foreign companies which now monopolize the field; the establishment of a paper mill, a factory for making sulphuric acid, and a glass factory.

REVISION OF INTER-ISLAND PASSENGER AND SHIPPING RATES.

According to Executive Order No. 114, dated November 5, 1909, H. B. McCoy, Insular Collector of Customs, L. F. Goodale, Supervising Railway Expert, and J. S. Reis, Assistant Director of Navigation, were appointed a committee to investigate, examine into, and present recommendations as to the rates which should be charged for the carriage of freight and passengers in the coastwise trade of the Philippine Islands.

In the preparation of this recommendation said committee may take into acccount and recommend general and commodity rates for freight and may classify either of said kinds; may classify ports and vessels and generally make such recommendations as to them may seem advisable and wise concerning any matter submitted to them for examination and recommendation.

Mr. McCoy was designated chairman of said committee which should meet at his call, hold such meetings, either closed or public, as might be necessary and report to the Governor-General of the Philippine Islands the result of their deliberations at the earliest practicable date.

The "Enterprise" calls special attention to the abnormally high first-class passenger rate between Iloilo and Manila. It estates that for a distance of 350 miles ₱40 are charged for a trip that takes only about thirty to thirty-six hours. It is claimed that in Spanish times this same service was rendered at not to exceed ₱20, and good profits were made by the vessel owners. In the United States the charge for such transportation would not exceed ₱8. With a reduction in fares and freight rates the traffic would certainly be greatly increased and every additional passenger would mean much additional trade and patronage for all kinds of commercial establishments in both Iloilo and Manila.

SOME RESOLUTIONS BY THE SUGAR GROWERS' CONVENTION.

In the sugar growers convention of Panay and Negros held in Bacolod, Occidental Negros, October 15, the following resolutions were passed:

I. The immediate establishment of offices for the polarization and grading of sugar in Iloilo, Cebu, and Manila.

II. A law providing for the immigration of foreigners, for agricultural purposes only, for a period of five years.

III. The formation of a sugar syndicate to control the Philippine market.

IV. That each municipality set aside not less than 4 hectares of land for use as an experiment station.

V. A law requiring the teaching of agriculture in the public schools.

PHILIPPINE POSTAL SAVINGS BANK.

The monthly report of the chief of the Philippines Postal Savings Bank for September shows a gain of 349 in the number of accounts opened, and a gain of ₱36,872.40 in deposits made during the month of September. The number of depositors on September 30 were 9,609 who had deposited ₱1,495,922.37. Of these depositors 5,596 were Filipinos, 3,419 Americans, 313 Europeans and 219 Asiatics. From the above statement it will be seen that the bank is steadily growing in favor with the Filipino people; the number of Filipino depositors exceeds those of any other nationality by more than 2,000 and the depositors of all other nationalities by more than 1,600.

The following statement of resources and liabilities should be of interest to everyone concerned in the prosperity and progress of the country.

Resources.		Liabilities.	
Loans secured by banks	₱780,000.00	Deposit fund; due depositors	₱1,495,922.37
Bonds, railway	573,391.05	Stamp fund; stamps outstanding	1,584.20
Real estate loans, first mortgages	106,525.00	Interest fund; balance	15,794.89
Cash on hand:			
Postal saving banks	45,918.60		
Insular Treasury	5,466.81		
Total	1,511,301.46	Total	1,511,301.46

A NEW HEMP-STRIPPING MACHINE.

Messrs. Burn & Co., Limited, of Calcutta, India, have through their representative, Mr. A. W. Prautch, made application to the division of archives and patents of the Executive Bureau for a patent on their new hemp-stripping machine which they believe is superior to everything else of the kind at present on the market. The machine put out by this company is said to have been operated successfully all through India. The capacity of the machine is claimed to be 1,000 pounds of hemp per day; the hemp is fed at the top of the machine, through three corrugated rollers which are placed in the shape of a V. At the end of these rollers it is clamped and run through a single set of strippers revolving on a wheel that makes 1,000 revolutions per minute. At the point of contact with the strippers a powerful stream of water plays on the hemp just as it reaches the strippers, and another stream cleans from the fiber, when it passes the knives, any pulp that has not been previously removed. After this simple process the hemp falls on an endless chain about 3 feet wide, which carries it back within a few feet of the starting point.

THE ILOILO RICE MILL.

The mill of the Iloilo Rice Mill Company on the La Paz side of the river is now in full operation and is turning out some 300 sacks of fine cleaned and polished rice per day. This is an industry which has a great future in the Islands. With the constantly increasing protection for the native-grown article, through the raising of the import duty, more and more rice will be planted and grown here.

The great trouble of the mills' management now and for some time to come will be to secure enough palay, or unhusked rice, to keep the mill working up to its full capacity. The natives have been in the habit of storing the palay in the towns where it is raised for about eight months and then selling it in their own vicinity at a fine profit. It will be hard to induce them to bring it in to a mill for husking as they have always done that themselves by the old mortar and pestle method. It is understood that the railroad company will make an effort to increase the business of the mill in order to secure traffic for its freight department.

ARTESIAN WELLS IN THE PHILIPPINES.

The value of artesian wells from an economical as well as from an hygienic standpoint is clearly set forth in the reports of the Directors of Health and Public Works. The work of drilling artesian wells was first begun in 1904. The Director of Public Works says that requests for artesian wells are constantly increasing in number, and are in many cases accompanied by resolutions of the interested provinces or municipalities to pay the expenses incurred in drilling the proposed wells. The sanitary value of artesian water as compared with water from the usual surface sources is appreciated by a large number of municipal officials.

Summary of successful artesian wells drilled during the fiscal year 1909.

Province.	Municipality.	Successful wells, rig.		Remarks.
		Deep.	Jet.	
Batangas	Batangas	1		
Do	Bauan	1		
Bohol	Candijay		1	
Do	Getafe		1	
Do	Guindulman		1	
Do	Mabini		1	
Do	Talibon		1	
Do	Ubay		1	
Cebu	Cebu		14	
Leyte	Carigara		3	Flowing.
Occidental Negros	Bacolod		2	
Pampanga	Guagua		1	Do.
Do	Santa Teresa		2	Do.
Pangasinan	Binalonan		1	
Do	Calasiao	1		Do.
Do	Dagupan	2		Do.
Do	Lingayen	1		Do.
Do	Pozorrubio		3	2 flowing.
Rizal	Alabang	2		
Do	Malabon	1		Flowing.
Do	Montalban		3	
Do	Navotas	1		
Do	Pasay	1		
Do	San Mateo		4	
Total		11	39	

NOTES FROM OTHER FIELDS.

COTTON IN BRITISH NORTH BORNEO.

Some samples of cotton grown in Baram, Sarawak, British North Borneo, were forwarded by the British resident of Baram to Professor Dunstan of the Imperial Institute in London with a request for a report as to their value. The report on the same stated that the sample consisted of clean, ginned cotton which was harsh, fairly lustrous, and of a deep cream color, with a pale reddish tinge. The length of the fiber is given as from 1.1 to 1.5 inches. The commercial value is quoted as 6.5 pence per pound while good rough Peruvian is quoted at 7.75 pence per pound, and good, moderately rough Peruvian at 6.60 pence per pound. This cotton is rough and very similar in character to Peruvian cotton. It is of good quality and would be readily saleable in the United Kingdom. It will therefore be seen that in case the Dyaks could be induced to continue the cultivation and to collect and send the cotton to Singapore for shipment a good market could be found for the product.

THE SUGAR INDUSTRY IN JAVA.

The annual report of the experiment station for the Java sugar industry for 1908, makes mention of the sudden dying out of sugar cane in several cases; this has been attributed in most cases to the high concentration of salts in the soil water, ammonium sulphate showing an abnormally high percentage. Sugar growers are also warned that phosphate manures should not be used for sugar cane unless chemical analysis of the soil shows that it is necessary. The use of potash manure is always advised against, on account of the fact that too little of this constituent is rarely found present in the soil for the plant's needs.

The question of the advisability of removing the trash from canes has also been considered. It has been found expedient to strip the lower, dead leaves, as their presence in the cane interferes with the production of roots when it is earthed up. Trashing up has never been found to be of any advantage, except as a preventive of the spreading of cane fires.

Regarding the methods of planting it is stated that on certain estates growing cane in rows 4 feet apart gives a greatly increased yield. Other subjects dealt with in this report are investigations into the use of

"blankit" as compared with that of sulphur dioxide for decolorizing purposes, and the heating value of the "magass" from different varieties of the cane. With regard to the first it has been found that the results from careful sulphuring are as good as those from the employment of blankit with the additional advantages of low cost and no loss of sugar. Observations on the use of magass for fuel show that some varieties possess a greater heating power than other kinds, chiefly on account of their higher fiber content.

CHEAP LABOR IN JAVA.

According to Consul B. S. Rairden, of Batavia, Java, the small wages paid to the laborers on the tobacco plantations are in striking contrast to the wages paid for similar labor in the United States. Consul Rairden states that the men receive as low as 10 cents per day for hard labor in the tobacco fields of Java, and the most industrious believe themselves well off at 16 cents per day. The Japanese women are paid from 6 to 12 cents, and the children from 4 to 6 per day. Tobacco cultivation is carried on either on land leased by Europeans or by the natives themselves who own the land. One thousand plants yield $4 worth of green tobacco and $1 worth of dry.

PETROLEUM IN BURMA.

According to a report of Consul E. A. Wakefield, of Burma, the Burma oil fields have been worked since the eighteenth century, but it is only since 1889 that the industry has been operated with modern appliances and in a businesslike manner. Prior to that date the work was carried on only intermittently by the Burmese oil diggers. The richest oil-bearing tract of Burma lies in the valley of the Irrawaddy, in upper Burma, considerable oil is still obtained from wells dug by native labor, but the principal output is from wells regularly drilled with modern machinery. A royalty is paid to the Government of 16 cents per 100 viss (365 pounds) in the case of early leases, and 16 cents per 40 gallons in later ones. A system of pipe lines has been installed. The first section is about 45 miles in length connecting the fields of Singu and Yenangyat with Yenangyang, and pumping stations are installed at Singu and Yenangyat. As these lines were successfully operated, the construction of a pipe line from Yenangyuang to Rangoon, a distance of 275 miles, was begun in 1907, and is now completed. This will materially lessen the cost of transporting oil from the fields to the refineries.

From the by-products obtained from crude petroleum, such as paraffin wax and mineral oil, in 1907 and 1908, 5,307,312 pounds of candles

were made, valued at $486,771 of which 661,000 pounds valued at $60,000 were exported to the Philippines, and 74,205 hundredweight, of wax valued at $547,411, of which $35,000 worth were exported to the United States and $12,000 to the Philippines.

CUBA'S LARGEST SUGAR MILL.

The largest and best equipped sugar mill on the Island of Cuba, Central Chappara, in Oriente Province, according to the Tampa Florida Times, this year broke the record for the production of sugar, which, according to this paper, produced 483,000 sacks, of 13 arrobas to the sack.[1] The total amount in arrobas was 6,279,000. This production it is claimed is the largest ever reached by any sugar mill in the world, and valued at 75 cents an arroba, would give the total product a valuation of $4,709,250.

CUBA SUGAR REVIEW FOR SEPTEMBER.

On the 5th of August the new tariff bill was finally passed reducing the duty on refined sugars 0.05 cent per pound and leaving the duty on raw sugar from Cuba and foreign countries unchanged. The new tariff permits the admission of 300,000 tons of Philippine Islands sugar free of duty each fiscal year. Since the new tariff went into effect three sail cargoes of Philippine sugars, afloat, have been sold on private terms, understood to be around 3.40 cents landed, on a basis of 88° test and no duty; one or two steamer cargoes for August-September shipment have also been placed.

European markets during August have been active and excited, with a squeezing of shorts and an advance on prompt beet from 10 shillings 8½ pence to 11 shillings 9¾ pence, and today September beet is quoted at 11 shillings 6¾ pence; October beet, however, is now quoted at 10 shillings 4½ pence, the parity of 4.19 cents for centrifugals at New York.

The new European beet crop has recovered somewhat from its backwardness. Thus far no sales of European beet sugars for shipment to the United States are reported, but it is just possible that some supplies may have to be drawn from Europe before the new Cuba crop campaign opens. There are still three centrals grinding the old crop of sugar cane in Cuba, and the visible production of sugar to date is 1,465,000 tons, making the largest crop on record; the growing crop is very promising and may considerably exceed the old crop if reports continue to be favorable. The indications are that good prices will be paid for the first new sugars of the Cuba crop.

[1] An arroba is a Spanish measure containing 25 pounds.

INDIAN CATTLE IN JAMAICA.

For some years past the English colony in Jamaica has been importing different breeds of Indian cattle. According to Volume I., No. 2, of the "Bulletin of the Department of Agriculture," the first Indian cattle were sent to Shettlewood pen more than half a century ago by the late Lord Howard de Walden, who at the time was ambassador at Lisbon, and it is quite likely that they were from the Portuguese settlement of Goa in southern India. These animals have always been noted as workers and as being much hardier than the cattle of Jamaica. The stock from this strain have been spread over many of the pens in the northern and western parts of the Island and have done much to improve the working qualities of the cattle in those districts. In September, 1880, five pure-bred Mysore cattle were sent by Lady Howard de Walden to Shettlewood pen. These shipments comprised two bulls, two cows, and a bull calf born on the voyage. It is believed that they were selected from the herd of the Rajah of Mysore. Later other importations of the Amrat Mahal, Gugerat, Gir, and Hissar breeds were made. Of the four different breeds which have been introduced into Jamaica it is claimed that the Hissar cattle are the best for general purposes, the Mysore are matchless for road work and are largely used in the banana districts in place of mules. It is said they never go lame nor get sick, and that they thrive and look well on the shortest ration when the native cattle hang their head and go to skin and bones.

THE CUBAN TOBACCO INDUSTRY.

According to Sr. Rafael M. Ybor, the Cuba consul at Tampa, Florida, there are 150 sugar factories now running in Cuba, all of which are housed in substantial buildings many of which cost more than $1,000,000. The cigars made in Cuba are all of high class and practically none are made to sell for less than $60 per thousand. He estimates the output of cigars made in the Havana factories for the past five years as follows: 1904, 401,861,082; 1905, 441,544,496; 1906, 452,865,529; 1907, 364,400,997; 1908, 337,012,184. From the above it will be seen that the output of the Havana cigar factories has considerably decreased since 1906.

UNITED STATES CROP REPORT FOR SEPTEMBER.

The United States Crop Reporter for September, published by the Secretary of Agriculture, gives the average condition of the tobacco crop on September 1 as 80.2 per cent against 83.4 per cent for last month, and 84.3 per cent on September 1, 1908. The average percentage for the tobacco crop on September 1 for the past ten years has been 82.7 per cent.

The following statement of exports of farm products from the United

States for the year ending June 30, 1909, it is believed, will be of interest:

Article.		1908.	1909 (preliminary).
Horses, number	Quantity	19,000	21,616
	Value	$2,612,587	$3,386,617
Mules, number	Quantity	6,609	3,432
	Value	$990,667	$472,017
Cattle, number	Quantity	349,210	207,542
	Value	$29,339,134	$18,046,976
Swine, number	Quantity	30,818	18,655
	Value	$307,202	$144,605
Fowls	Value	$151,925	$115,946
Eggs, dozen	Quantity	7,590,977	5,207,151
	Value	$1,540,014	$1,199,522
Rice, pounds	Quantity	2,195,947	1,566,531
	Value	$87,687	$60,814
Coffee, pounds	Quantity	39,657,138	29,616,378
	Value	$4,788,471	$3,885,616
Cotton, pounds	Quantity	3,816,998,693	4,447,985,202
	Value	$137,788,202	$117,390,665
Sugar, pounds	Quantity	25,510,643	79,946,297
	Value	$974,184	$2,785,076
Tobacco	Quantity	330,812,658	287,900,946
	Value	$34,727,157	$30,902,900

BANANA ALCOHOL.[1]

To be properly appreciated bananas must be offered for consumption at a suitable degree of ripeness. Therefore, it is necessary to pick them green and let them ripen, at least partly, during the voyage to the market. But in spite of good care the loss through spoiled and rejected fruit is estimated at 20 per cent. According to information furnished by the Agricultural Society of Jamaica this loss alone represents 2,000,000 bunches.

In the face of this state of affairs producers have been trying to find some industrial use for this enormous quantity of fruit. They have tried drying and preserving, and they have cooked it with sugar and made flour of it, but experiments made in this direction have been without results. Therefore it is necessary to seek for the bananas that can not be sold another outlet than those already referred to.

At one time Mr. d'Hérelle, now chief of the experiment station at Merida, Yucatan, but then director of a distillery at Puerto Barrios, Guatemala, proposed a process for obtaining an alcohol for drinking from bananas. Experiments made in the laboratory with bananas which had been rejected, and were destined to be thrown into the sea or to rot on the beach, permitted us to obtain a good spirit, very much like whisky. Samples sent to the St. Louis Exposition, that had only been in the barrel for six months, were recognized to be of superior quality. After analysis by the laboratory of the Department of Agriculture in Washington, the producers were awarded a gold medal. Alcohol ages so rapidly in tropical countries that one year in the barrel is sufficient to

[1] From The Cuba Review, Vol. III, No. 10, September, 1909.

make the product very fine. Corn whisky must be kept in casks for several years before being offered for consumption, and at least five years to obtain the best qualities. Banana whisky is ripe at the end of one year. We are sure that the samples submitted at the St. Louis Exposition bore comparison with those that had not been less than ten years in casks.

After having demonstrated that it is possible to obtain by fermentation of banana juice a marketable product of good quality, it is in order to consider the cost of manufacture. It may be said that it is much less than that of ordinary whisky. The yield may be estimated at 4½ liters per bunch of bananas. A memorandum of expenses made for a plant capable of producing 150 casks of whisky daily aggregated 827,500 francs, this included buildings, machinery, and apparatus, fuel, labor, administration, general expenses for two years, cases and bottles for the preparation of one year, and raw material for manufacture for two years (270,000 bunches, at 75 centimes each).

METHODS FOR DESTROYING RATS IN THE UNITED STATES.

The following extracts are made from the Farmers' Bulletin 369, by David E. Lantz, assistant in the Bureau of Biological Survey, United States Department of Agriculture.

The following are important aids in limiting the number of rats and reducing the losses from their depredations:

1. Protection of our native hawks, owls, and smaller predatory mammals—the natural enemies of rats.

2. Greater cleanliness about stables, markets, grocery stores, warehouses, courts, alleys, and vacant lots in cities and villages, and like care on farms and suburban premises. This includes the storage of waste and garbage in covered vessels and the prompt disposal of it each day.

3. Care in the construction of buildings and drains, so as not to provide entrance and retreats for rats, and the permanent closing of all rat holes in old houses and cellars.

4. The early thrashing and marketing of grains on farms, so that stacks and mows shall not furnish harborage and feed rats.

5. Removal of outlying straw stacks and piles of trash or lumber that harbor rats in the fields.

6. Rat-proofing of warehouses, markets, cribs, stables, and granaries for storage of provisions, seed grain, and feed stuffs.

7. Keeping effective rat dogs and cats, especially on farms and in city warehouses.

8. The systematic destruction of rats, whenever and wherever possible, by (*a*) trapping, (*b*) poisoning, and (*c*) organized hunts.

9. The organization of rat clubs and other societies for systematic warfare against rats.

The value of carnivorous mammals and the larger birds of prey in destroying rats should be more fully recognized, especially by the farmer

and the game preserver. Rats actually destroy more poultry and game, both eggs, and young chicks, than all the birds and wild mammals combined; yet some of our most useful birds of prey and carnivorous mammals are persecuted almost to the point of extinction. An enlightened public sentiment should cause the repeal of all bounties on these animals and afford protection to the majority of them.

Arsenic is probably the most popular of the rat poisons, owing to its cheapness; yet our experiments prove that, measured by the results obtained, arsenic is dearer than strychnine. Besides, arsenic is extremely variable in its effect upon rats; and if the animals survive a first dose it is very difficult to induce them to take another.

Rats may be destroyed in their burrows in the fields and along river banks, levees, and dikes by carbon bisulphide. A wad of cotton or other absorbent material is saturated with the liquid and then pushed into the burrow, the opening being packed with earth to prevent the escape of the gas. All animals in the burrow are asphyxiated. Fumigation in buildings is not so effective, because it is difficult to confine the gases. Moreover, when effective, the odor from the dead rats is highly objectionable in occupied buildings.

Several microörganisms, or bacteria, have been exploited in Europe and America for destroying rats. A number are on the market in the United States. With the aid of the biochemic division of the Bureau of Animal Industry, the Biological Survey has made laboratory and field experiments with some of them, and has received many reports from others who have tried the cultures in a practical way. The results are by no means uniform, although the majority are negative. The chief defects to be overcome before the cultures can be recommended for general use are:

1. The virulence is not great enough to kill a sufficiently high percentage of rats that eat food containing the microörganisms.

2. The virulence decreases with the age of the cultures. They deteriorate in warm weather and in bright sunlight.

3. The diseases resulting from the microörganisms are not contagious and do not spread by contact of diseased with healthy animals.

4. The comparative cost of the cultures is too great for general use. Moreover, considering the skill and care necessary in their preparation, it is doubtful if the cost can be greatly reduced.

AGRICULTURAL EDUCATION IN THE UNITED STATES.

According to the editor of the "Experiment Station Record" for August nearly one-half of all of the addresses, papers, and reports presented at the National Education Association at its last meeting in Denver, dealt in some direct way with one or more phases of industrial education. So decidedly did this subject dominate all others that it shows clearly the most universal demand for a change in the public school curricula along lines giving greater emphasis to local industrial and domestic affairs.

agriculture, manual arts, and home economics. The trend of the discussion at the convention indicated that the idea of education was not so much to uplift agriculture, manufacturing, or business, as it is to raise the level and increase the efficiency and happiness of those engaged in these pursuits. The establishment of our school system in the United States has been to train pupils for advanced education and the ideals of life held before them are those of the professions of law or medicine and of holding public office.

The problem of relating the country schools more closely to the life and needs of the people was discussed more at length in the department of rural and agricultural education and a new kind of education adapted to the real needs of the country people. It demands a new point of view in teaching the subjects now generally included in the public school curriculum to the end that nonessentials shall be eliminated and greater correctness and effectiveness shall be acquired through problems and illustrations drawn from the farms, the home, and the common things in the natural and ordinary evironment of the children.

HEMP STATISTICS.

EXPORTS, IN BALES, FOR SEPTEMBER.

[Far Eastern Review, October, 1909.]

Date.	Vessel.	London.	Liverpool.	Atlantic, United States.	Pacific East and California.	Continent.	Australia.	Other ports.	Total bales.
1909.	Forward	174,120	94,449	389,257	81,408	39,901	11,837	23,573	814,545
Sept. 1	Keemun				2,300				2,300
Sept. 1	Carmarthenshire	5,029				2,702			7,731
Sept. 1	Kaifong Cebu	3,514							3,514
Sept. 3	Yuengsang		250			150		15	415
Sept. 4	Zafiro		250			646		150	1,046
Sept. 5	Lothian			22,275					22,275
Sept. 7	Isla de Panay		300			50			350
Sept. 7	Nikko Maru						720		720
Sept. 10	Loongsang							300	300
Sept. 12	Henrick Ibsen				500				500
Sept. 13	Prinz Waldemar						600		600
Sept. 16	Dakotah				4,055				4,055
Sept. 17	Yuengsang	250				237		100	587
Sept. 18	Prinz Sigismund							173	173
Sept. 18	Eastern							100	100
Sept. 19	Zafiro	1,546							1,546
Sept. 21	Atlas			21,730					21,730
Sept. 21	Tean					550			550
Sept. 23	Teucer		2,300						2,300
Sept. 23	Siberia			28	700				728
Sept. 23	Suveric				12,237				12,237
Sept. 25	Rubi	454				1,000		200	1,654
Sept. 25	Yawata Maru							123	123
Sept. 25	Loongsang	4,012				450		350	4,812
Sept. 26	Montrose (Cebu)			25,258					25,258
Sept. 26	Taiyuan						480		480
Sept. 28	Courtfield	1,800	2,431			750			4,981
Sept. 28	Taming	2,157				850			3,007
	Total for September 1909	192,882	99,980	458,548	101,200	47,286	13,637	25,084	938,617

ILOILO SUGAR SHIPMENTS.

[From Weekly Shipping Circular of José T. Figueras.]

October shipments, 1909.

Date.	Vessel.	Destination.	Superior (piculs).
October 18	Seminole	S. Francisco	88,000
October 21	Sungkiang	Hongkong	2,681
Total for October			90,681

Export on October 30, 1908 and 1909.

[In kilos.]

To—	1907–8 crop.		1908–9 crop.	
	Superior.	Wet.	Superior.	Wet.
Great Britain	105,600			
United States	728,000		808,400	
Japan	12,000	22,271	50,667	8,915
China	541,428	20,912	772,649	
India	4,000			
Total	1,391,028	43,183	1,632,716	8,915

PRINCIPAL PHILIPPINE IMPORTS AND EXPORTS, OCTOBER, 1909.

IMPORTS.

Articles.		Units.	Manila.	Cebu.	Iloilo.	Jolo.	Zamboanga.	Balabac.	Davao.	Total.
Rice	Value	Dollars	288,277	201,628	50,083	2,026	8,683			550,697
	Quantity	Kilos	10,215,066	5,662,206	1,986,092	54,942	257,231			18,175,537
Beef cattle	Value	Dollars	55,516	2,974	3,002		535			62,027
	Quantity	Numbers	2,438	119	127		8			2,692
Hogs	Value	Dollars	243							243
	Quantity	Numbers	5							5
Eggs	Value	Dollars	17,889	7	14		59			17,969
	Quantity	Kilos	53,480	158	309		379			54,325
Sugar	Value	Dollars	8,180	1,203	607	207	389			10,586
	Quantity	Kilos	121,905	21,482	8,969	3,190	5,642			161,188
Coffee	Value	Dollars	9,895	873	481	349	1,497			13,095
	Quantity	Kilos	43,112	4,394	2,361	1,414	6,154			57,438
Cacao	Value	Dollars	18,240	3,074	7		19			21,340
	Quantity	Kilos	74,597	10,744	67		16			85,424
Raw cotton	Value	Dollars								
	Quantity	Kilos								

EXPORTS.

Hemp	Value	Dollars	1,205,673	435,857		235	400			1,642,165
	Quantity	Kilos	11,368,075	4,309,502		2,558	655			15,680,790
Sugar	Value	Dollars		2,800	1,049,293					1,052,093
	Quantity	Kilos		63,968	17,287,392					17,351,360
Copra	Value	Dollars	493,587	213,606		4,407	35,810			647,410
	Quantity	Kilos	7,397,368	2,522,385		63,761	467,396			10,450,910
Tobacco	Value	Dollars	220,083							220,083
	Quantity	Kilos	1,581,623							1,581,623
Cigars	Value	Dollars	211,632							211,632
	Quantity	Thousands	17,157							17,157
Cigarettes	Value	Dollars	2,371							2,371
	Quantity	Thousands	2,703							2,703

TEMPERATURE AND RAINFALL FOR AGRICULTURAL DISTRICTS IN THE PHILIPPINES, OCTOBER, 1909.

By the DIRECTOR OF THE WEATHER BUREAU.

[Temperature and total rainfall for twenty-four hours beginning at 6 a. m. each day.]

Date.	Hemp.				Sugar, Iloilo.		Rice, Tarlac.		Tobacco.			
	Albay.		Tacloban.						Aparri.		San Fernando.	
	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.	Temperature.	Rainfall.
	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.	°C.	mm.
1	28.0	------	26.5	------	26.2	13.0	28.4	------	28.0	19.6	28.6	------
2	27.2	39.4	27.7	------	24.6	41.1	28.6	------	26.0	5.6	27.9	37.1
3	25.7	53.8	27.5	5.6	26.2	56.1	27.7	------	27.5	29.7	27.2	0.5
4	25.8	20.8	27.4	------	25.8	19.3	27.5	3.8	25.5	45.2	27.4	5.1
5	26.2	6.6	27.5	14.0	25.0	82.0	26.4	1.0	23.9	22.3	25.6	60.5
6	26.6	14.7	27.6	------	26.1	22.1	27.2	0.5	25.0	41.1	25.8	13.5
7	27.1	------	28.4	9.1	26.3	------	26.6	35.3	24.6	60.4	26.8	22.9
8	26.8	8.4	26.1	11.7	26.6	1.5	27.9	41.5	25.4	5.8	26.7	10.2
9	25.8	4.8	26.6	------	26.6	1.0	27.0	30.0	26.8	1.8	27.6	1.3
10	26.3	36.3	26.1	------	26.3	0.5	28.4	14.0	27.0	6.9	27.0	------
11	27.8	1.8	27.0	0.8	27.2	5.6	26.8	------	27.7	------	27.6	------
12	28.0	------	27.3	------	27.2	------	27.7	------	27.4	------	27.8	0.3
13	28.2	0.3	26.5	3.6	27.5	------	28.5	------	27.8	------	28.0	------
14	28.9	------	27.2	------	27.2	3.3	29.1	------	27.3	------	28.0	------
15	27.6	0.5	27.5	1.0	27.2	------	28.5	------	27.0	9.6	28.0	------
16	27.6	0.3	28.0	------	27.4	------	28.4	------	27.9	39.6	27.9	------
17	28.1	0.3	29.0	------	28.2	0.5	26.6	0.5	------	15.2	25.4	86.4
18	28.4	------	28.6	------	27.5	20.1	26.4	14.5	------	------	24.1	22.9
19	27.8	------	28.2	------	26.7	4.8	26.8	5.3	------	------	27.0	------
20	27.3	------	28.3	------	26.9	------	28.4	------	------	------	27.2	9.1
21	27.9	------	26.8	1.0	26.9	8.9	29.0	1.8	------	------	27.4	------
22	27.6	14.5	27.0	35.9	27.2	------	28.9	------	------	0.5	28.2	------
23	24.6	95.8	24.7	50.3	26.4	15.0	29.6	61.0	------	2.5	28.0	------
24	27.6	0.5	27.5	5.8	26.7	5.6	23.6	69.1	------	25.4	27.2	------
25	28.0	3.0	27.0	2.0	26.9	0.8	27.6	------	------	0.3	28.0	------
26	27.4	69.1	27.3	------	27.4	4.8	28.0	------	------	------	27.1	------
27	26.9	42.7	26.9	18.3	27.6	13.7	28.0	0.5	------	------	27.5	------
28	27.7	2.5	27.6	------	26.8	4.1	27.7	1.0	------	------	27.0	------
29	27.6	22.9	26.8	------	26.7	19.0	27.4	0.3	------	1.0	27.2	------
30	27.3	1.5	25.8	7.4	27.0	------	27.6	------	------	------	27.9	------
31	27.4	7.4	27.5	------	27.7	------	27.8	------	------	------	27.5	------

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Journal of the Department of Agriculture of Victoria, Melbourne, Australia.
Journal of the Department of Agriculture of Western Australia, Perth.
Journal of the College of Agriculture, Tokyo, Japan.
Hawaiian Forester and Agriculturist, Honolulu, Territory of Hawaii.
Tropical Agriculturist, Colombo, Ceylon.
The Agricultural Journal of India, Calcutta.
Memoirs of the Department of Agriculture, Calcutta, India.
Natal Agricultural Journal, Pietermaritzburg, Natal, South Africa.
Agricultural News, Bridgetown, Barbados.
West Indian Bulletin, Bridgetown, Barbados.
The West Indian Committee Circular, London.
The Cuba Review, New York.
Bulletin of the Department of Agriculture, Kingston, Jamaica.
Journal of the Jamaica Agricultural Society, Kingston.
Bulletin of Agricultural Information, Trinidad.
Journal of the Board of Agriculture of British Guiana, Georgetown.
California Cultivator, Los Angeles, California.
The Rural Californian, Los Angeles, California.
Farmer and Fruit Grower, Jacksonville, Florida.
Louisiana Planter, New Orleans, Louisiana.
Southern Cultivator, Atlanta, Georgia.
Progressive Farmer, Raleigh, North Carolina.
Farmer's Guide, Huntington, Indiana.
Kansas Farmer, Topeka, Kansas.
Farm Press, Chicago, Illinois.
The American Florist, Chicago and New York.
The Feather, Washington, D. C.
The American Thresherman, Madison, Wisconsin.
Oregon Agriculturist, Portland, Oregon.
Journal of Agriculture and Horticulture, Montreal, Canada.
The Gardeners' Chronicle, London.
Commercial America, Philadelphia, Pennsylvania.
Tropical Life, London, England.
Horn and Hoof, Seattle, Washington.
The Breeders' Gazette, Chicago, Illinois.
The Journal of Tropical Veterinary Science, Calcutta, India.
American Veterinary Review, New York.

REPORTS AND QUOTATIONS.

Crop Reporter, by the Secretary of Agriculture, Washington, D. C.
Monthly Consular and Trade Reports, Washington, D. C.
Federal Reporter, New York, N. Y.
Smith and Schipper's Monthly Report, New York, N. Y.
Hanson and Orth, Hemp Brokers, Monthly Statement, New York.
Hemp Market Report, Landauer & Co., London.
Ide and Christie's Monthly Circular, London.
Exporters and Importers Journal, Chicago, Illinois.
Quarterly Summary of Commerce of the Philippine Islands, Washington, D. C.
Ker & Co's. Price Current, Manila, Iloilo, and Cebu, P. I.
Weekly Shipping Circular (Sugar), Jose T. Figueras, Iloilo, P. I.

LOCAL.

Official Gazette, Manila, P. I.
Far Eastern Review, Manila, P. I.
Philippine Journal of Science, Manila, P. I.
Weather Bureau Bulletins, Manila, P. I.
The Philippine Agricultural Review, Manila, P. I.

SPANISH.

Boletin de la Cámara de Comercio Filipina, Manila, P. I.
Boletin Oficial de la Secretaría de Agricultura, Comercio y Trabajo, Cuba.
Boletin de Agricultura, San José, Costa Rica.
Hacendado Mexicano, El, Mexico, Mexico.
Hacienda, La, Buffalo, New York.
Industrias Americanas, New York, N. Y.
Revista del Ministerio de Obras Públicas, Bogotá, Colombia.
Agricultor Peruano, El, Lima, Peru.
Revista de la Asociación Rural del Uruguay, Montevideo.
Prácticas Modernas é Industrias Rurales, La Coruña, Spain.
Resumen de Agricultura, Barcelona, Spain.

OTHER LANGUAGES.

Bulletin de la Chambre de Commerce de Saigon, Saigon, Indo-China.
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